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THE EXPERIENCE OF ACTIVITY.[1]

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Brethren of the Psychological Association:

In casting about me for a subject for your President this year to talk about it has seemed to me that our experiences of activity would form a good one; not only because the topic is so naturally interesting, and because it has lately led to a good deal of rather inconclusive discussion, but because I myself am growing more and more interested in a certain systematic way of handling questions, and want to get others interested also, and this question strikes me as one in which, although I am painfully aware of my inability to communicate new discoveries or to reach definitive conclusions, I yet can show, in a rather definite manner, how the method works.

The way of handling things I speak of, is, as you already will have suspected, that known sometimes as the pragmatic method, sometimes as humanism, sometimes as Deweyism, and in France, by some of the disciples of Bergson, as the Philosophie nouvelle. Professor Woodbridge's *Journal of Philosophy* seems unintentionally to have become a sort of meeting place for those who follow these tendencies in America. There is only a dim identity among them; and the most that can be said at present is that some sort of gestation seems to be in the atmosphere, and that almost any day a man with a genius for finding the right word for things may hit upon some unifying

[1] President's Address before the American Psychological Association, Philadelphia Meeting, December, 1904.

and conciliating formula that will make so much vaguely similar aspiration crystallize into more definite form.

I myself have given the name of 'radical empiricism' to that version of the tendency in question which I prefer; and I propose, if you will now let me, to illustrate what I mean by radical empiricism, by applying it to activity as an example, hoping at the same time incidentally to leave the general problem of activity in a slightly — I fear very slightly — more manageable shape than before.

Mr. Bradley calls the question of activity a scandal to philosophy, and if one turns to the current literature of the subject — his own writings included — one easily gathers what he means. The opponents cannot even understand one another. Mr. Bradley says to Mr. Ward: "I do not care what your oracle is, and your preposterous psychology may here be gospel if you please; * * * but if the revelation does contain a meaning I will commit myself to this: either the oracle is so confused that its signification is not discoverable, or, upon the other hand, if it can be pinned down to any definite statement, then that statement will be false."[1] Mr. Ward in turn says of Mr. Bradley: "I cannot even imagine the state of mind to which his description applies. * * * It reads like an unintentional travesty of Herbartian Psychology by one who has tried to improve upon it without being at the pains to master it." Münsterberg excludes a view opposed to his own by saying that with any one who holds it a *Verständigung* with him is "*grundsätzlich ausgeschlossen*"; and Royce, in a review of Stout:[2] hauls him over the coals at great length for defending 'efficacy' in a way which I, for one, never gathered from reading him, and which I have heard Stout himself say was foreign to the intention of his text.

In these discussions distinct questions are habitually jumbled and different points of view are talked of *durcheinander*. There is a psychological question: "Have we perceptions of activity? and if so, what are they like, and when and where do we have them?" There is a metaphysical question: "Is there a *fact* of activity? and if so, what idea must we frame of it? What

[1] Appearance and Reality, p. 117. — Obviously written *at* Ward, though Ward's name is not mentioned.

[2] *Mind*, N. S., VI., 379.

is it like? and what does it do, if it does anything?" and finally there is a logical question: "Whence do we *know* activity? By our own feelings of it solely? or by some other source of information?" Throughout page after page of the literature one knows not which of these questions is before one; and mere description of the surface show of experience is proferred as if it implicitly answered every one of them. No one of the disputants, moreover, tries to show what pragmatic consequences his own view would carry, or what particular practical differences it would make if his adversary's were triumphant.

It seems to me that if radical empiricism be good for anything, it ought, with its pragmatic method and its principle of pure experience, to be able to avoid such tangles, or at least to simplify them somewhat. The pragmatic method starts from the postulate that there is no difference of truth that doesn't make a difference of fact somewhere; and it seeks to determine the meaning of all differences of opinion by making the discussion lead as soon as possible to some practical issue. The principle of pure experience is also a postulate. Nothing shall be admitted as fact, it says, except what can be experienced at some definite time by some experient; and for every feature of fact ever so experienced, a definite place must be found somewhere in the final system of reality. In other words: Everything real must be experienced, and every kind of thing experienced must somewhere be real.

Armed with these rules of method let us see what face the problems of activity present to us.

By the principle of pure experience, either the word 'activity' must have no meaning at all, or else the original type and model of what it means must lie in some concrete kind of experience that can be definitely pointed out. Whatever ulterior judgments we may eventually come to make regarding activity, *that sort* of thing will be what the judgments are about. The first thing to do then is to ask where in the stream of experience we seem to find what we speak of as activity. What we are to think of the activity thus found will be a later question.

Now it is obvious that we are tempted to affirm activity

wherever we find anything *going on*. Taken in the broadest sense, any apprehension of something *doing*, is an experience of activity. Were our world describable only by the words 'nothing happening,' 'nothing changing,' we should unquestionably call it an 'inactive' world. Elementary activity then, as we may call it, means the bare fact of event or change. 'Change taking place' is a unique content of experience, one of those 'conjunctive relations' between its successive parts which radical empiricism seeks so earnestly to rehabilitate and preserve. The sense of activity is thus in the broadest and vaguest way synonymous with the sense of 'life.' We should feel our own subjective life at least, even in noticing and proclaiming an otherwise inactive world. Our own reaction on its monotony would be the one thing experienced there in the form of an event.

This seems to be what certain writers have in mind when they insist that for an experient to be at all is to be active. It seems to justify, or at any rate to explain, Mr. Ward's expression that we *are* only as we are active,[1] for we *are* only as experients; and it rules out Mr. Bradley's contention that "there is no original experience of anything like activity." What we ought to say about activities thus elementary, whose they are, what they effect, or whether indeed they effect anything at all — these are later questions to be answered only when the field of experience is enlarged.

Elementary activity would thus be predicable, though there were no definite direction, no actor, and no aim. Mere restless zigzag movement, or a wild *Ideenflucht*, or *Rhapsodie der Wahrnehmungen*, as Kant would say, would constitute an active as distinguished from an inactive world.

But in this actual world of ours, as it is given, a part at least of the activity comes with definite direction; it comes with desire and sense of goal; it comes complicated with resistances which it overcomes or succumbs to, and with the efforts which the feeling of resistance so often provokes; and it is in complex experiences like these that the notions of distinct agents, and of

[1] *Naturalism and Agnosticism*, II., 245. One thinks naturally of the peripatetic *actus primus* and *actus secundus* here.

passivity as opposed to activity arise. Here also the notion of causal efficacy comes to birth. Perhaps the most elaborate work ever done in descriptive psychology has been the analysis by various recent writers of the more complex activity-situations.[1] In their descriptions, exquisitely subtle some of them,[2] the activity appears as the *gestaltqualität* or the *fundirte inhalt* (or as whatever else you may please to call the conjunctive form) which the content falls into when we experience it in the ways which the describers set forth. Those factors in those relations are what we mean by activity-situations; and to the possible enumeration and accumulation of their circumstances and ingredients there would seem to be no natural bound. Every hour of human life could contribute to the picture gallery; and this is the only fault that one can find with such descriptive industry — where is it going to stop? Ought we to listen forever to verbal pictures of what we have already in concrete form in our own breasts?[3] They never take us off the superficial plane. We knew the facts already — less spread out and separated, to be sure — but we knew them still. We always felt our own activity, for example, as 'the expansion of an idea with which our Self is identified, against an obstacle'; and the following out of such a definition through a multitude of cases elaborates the obvious so as to be little more than an exercise in synonymic speech.

All the descriptions have to trace familiar outlines, and to use familiar terms. The activity is, for example, attributed

[1] I refer to such descriptive work as Ladd's (*Psychology, Descriptive and Explanatory*, Part I., Chap. V., Part II., Chap. XI., Part III., Chaps. XXV. and XXVI.); as Sully's (*The Human Mind*, Part V.); as Stout's (*Analytic Psychology*, Book I., Chap. VI., and Book II., Chaps. I., II. and III.); as Bradley's (in his long series of analytic articles on Psychology in *Mind*); as Titchener's (*Outline of Psychology*, Part I., Chap. VI.); as Shand's (*Mind*, N. S., III., 449; IV., 450; VI., 289); as Ward's (*Mind*, XII., 67 ff., and 564); as Loveday's (*Mind*, N. S., X., 455); as Lipps's (Vom Fühlen, Wollen und Denken, 1902, Chaps. II., IV., VI.); and as Bergson's (*Revue Philosophique*, LIII., 1) — to mention only a few writings which I immediately recall.

[2] Their existence forms a curious commentary on Prof. Münsterberg's dogma that will-attitudes are not describable. He himself has contributed in a superior way to their description, both in his *Willenshandlung*, and in his *Grundzüge*, Part II., Chap. IX., § 7.

[3] I ought myself to cry *peccavi*, having been a voluminous sinner in my own chapter on the will.

either to a physical or to a mental agent, and is either aimless or directed. If directed it shows tendency. The tendency may or may not be resisted. If not, we call the activity immanent, as when a body moves in empty space by its momentum, or our thoughts wander at their own sweet will. If resistance is met, two agents complicate the situation. If now, in spite of resistance, the original tendency continues, effort makes its appearance, and along with effort, strain or squeeze. Will, in the narrower sense of the word then comes upon the scene, whenever, along with the tendency, the strain and squeeze are sustained. But the resistance may be great enough to check the tendency, or even to reverse its path. In that case, we (if 'we' were the original agents) are overpowered. The phenomenon turns into one of tension simply, or of necessity succumbed-to, according as the opposing power is only equal, or is superior to ourselves.

Whosoever describes an experience in such terms as these describes an experience *of* activity. If the word have any meaning it must denote what there is found. *There* is complete activity in its original and first intention. What it is 'known-as' is what there appears. The experiencer of such a situation possesses all that the idea contains. He feels the push, the obstacle, the will, the strain, the triumph or the passive giving up, just as he feels the time, the space, the swiftness or intensity, the movement, the weight and color, the pain and pleasure, the complexity, or whatever remaining characters the situation may involve. He goes through all that ever can be imagined where activity is supposed. If we suppose activities to go on outside of our experience it is in forms like these that we must suppose them, or else give them some other name; for the word 'activity' has no content save these experiences of process, obstruction, striving, strain, or release, ultimate *qualia* as they are of the life given us to be known.

Were this the end of the matter, one might think that whenever we had successfully lived through an activity-situation we should have to be permitted, without provoking contradiction, to say that we had been really active, that we had met real resistance and had really prevailed. Lotze somewhere says

that to be an entity all that is necessary is to *gelten* as an entity, to operate, or be felt, experienced, recognized, or in any way realized, as such. In our activity-experiences the activity assuredly fulfils Lotze's demand. It makes itself *gelten*. It is witnessed at its work. No matter what activities there may really be in this extraordinary universe of ours, it is impossible to conceive of any one of them being either lived through or authentically known otherwise than in this dramatic shape of something sustaining a felt purpose against felt obstacles and overcoming or being overcome. What 'sustaining' means here is clear to anyone who has lived through the experience, but to no one else; just as 'loud,' 'red,' 'sweet,' mean something only to beings with ears, eyes and tongues. The *percipi* in these originals of experience is the *esse;* the curtain is the picture. If there is anything hiding in the background, it ought not to be called activity, but should get itself another name.

This seems so obviously true that one might well experience astonishment at finding so many of the ablest writers on the subject flatly denying that the activity we live through in these situations is real. Merely to feel active is not to be active, in their sight. The agents that appear in the experience are not real agents, the resistances do not really resist, the effects that appear are not really effects at all.[1] It is evident from this that

[1] *Verborum gratiâ:* "The feeling of activity is not able, quâ feeling, to tell us anything about activity" (Loveday: *Mind*, N. S., X., 463); "A sensation or feeling or sense of activity * * * is not, looked at in another way, a feeling of activity at all. It is a mere sensation shut up within which you could by no reflection get the idea of activity. * * * Whether this experience is or is not later on a character essential to our perception and our idea of activity, it, as it comes first, is not in itself an experience of activity at all. It, as it comes first, is only so for extraneous reasons and only so for an outside observer" (Bradley, *Appearance and Reality*, 2d edition, p. 605); "In dem Tätigkeitsgefühle liegt an sich nicht der geringste Beweis für das Vorhandensein einer psychischen Tätigkeit" (Münsterberg: Grundzüge, etc., p. 67). I could multiply similar quotations and would have introduced some of them into my text to make it more concrete, save that the mingling of different points of view in most of these author's discussions (not in Münsterberg's) make it impossible to disentangle exactly what they mean. I am sure in any case, to be accused of misrepresenting them totally, even in this note, by omission of the context, so the less I name names and the more I stick to abstract characterization of a merely possible style of opinion, the safer it will be. And apropos of misunderstandings, I may add to this note a complaint on my own account. Professor Stout,

mere descriptive analysis of any one of our activity-experiences is not the whole story, that there is something still to tell *about* them that has led such able thinkers to conceive of a *Simon pure* activity, of an activity *an sich*, that does, and doesn't merely appear to us to do, and compared with which all this phenomenal activity is but a specious sham.

The metaphysical question opens here; and I think that the state of mind of one possessed by it is often something like this: "It is all very well," we may imagine him saying, "to talk about certain experience-series taking on the form of activities, just as they might take on musical or geometric forms. Suppose that they do so; suppose we feel a will to stand a strain. Does our feeling do more than *record* the fact? The will's activity meanwhile, is the *doing* of the fact; and what is the doing made of before the record is made. What in the will *enables* it to act? And these trains of experience themselves, in which activities appear, what makes them *go* at all? Does the activity in one bit of experience bring the next bit into being?

in the excellent chapter on 'Mental Activity,' in Vol. I., of his *Analytic Psychology*, takes me to task for identifying spiritual activity with certain muscular feelings and gives quotations to bear him out. They are from certain paragraphs on 'the Self,' in which my attempt was to show what the central nucleus of the activities that we call 'ours' is. I found it in certain intracephalic movements which we habitually oppose, as 'subjective,' to the activities of the transcorporeal world. I sought to show that there is no direct evidence that we feel the activity of an inner spiritual agent as such (I should now say the activity of 'consciousness' as such, see my paper 'Does consciousness exist?' in the *Journal of Philosophy*, Vol. I., p. 477). There are in fact three distinguishable 'activities' in the field of discussion: the 'elementary' activity involved in the mere *that* of experience, in the fact that *something* is going on, and the farther specification of this *something* into two *whats*, an activity felt as 'ours,' and an activity ascribed to objects. Stout, as I apprehend him, identifies 'our' activity with that of the total experience-process, and when I circumscribe it as a part thereof, accuses me of treating it as a sort of external appendage to itself (pp. 162–3), as if I 'separated the activity from the process which is active.' But all the processes in question are active, and their activity is inseparable from their being. It was in my book only a question of *which* activity deserved the name of 'ours.' So far as we are 'persons,' and contrasted and opposed to an 'environment,' movements in our body figure as our activities; and I am unable to find any other activities that are ours in this strictly personal sense. There is a wider sense in which the whole 'choir of heaven and furniture of the earth' and their activities, are ours, for they are our 'objects.' But 'we' are here only another name for the total process of experience, another name for all that is, in fact; and I was dealing with the

As an empiricist you cannot say so, for you have just declared activity to be only a kind of conjunctive relation experienced between bits of experience already made. But what made them at all? What propels experience *überhaupt* into being? *There* is the activity that *operates;* the activity *felt* is only its superficial sign."

To the metaphysical question, popped upon us in this way, I must pay serious attention ere I end my remarks, but, before doing so, let me show that without leaving the immediate reticulations of experience, or asking what makes activity itself act, we still find the distinction between less real and more real activities forced upon us, and are driven to much soul-searching on the purely phenomenal plane.

We must not forget, namely, in talking of the ultimate character of our activity-experiences, that each of them is but a portion of a wider world, one link in the vast chain of processes of which history is made. Each partial process, to him who lives through it, defines itself by its origin and its goal; but to an observer with a wider mind-span who should live outside of it, that goal would appear but as a provisional halting place,

personal and individualized self exclusively in the passages with which Professor Stout finds fault.

The individualized self, which I believe to be the only thing properly called self, is a part of the content of the world experienced. The world experienced (otherwise called the 'field of consciousness') comes at all times with our body as its center, center of vision, center of action, center of interest. Where the body is is 'here'; when the body acts is 'now'; what the body touches is 'this'; all other things are 'theres' and 'thens' and 'thats.' These words of emphasized position imply a systematization of things with reference to a focus of action and interest which lies in the body; and the systematization is now so instinctive (was it ever not so?) that no developed or active experience exists for us at all except in that ordered form. So far as 'thoughts' and 'feelings' can be active, their activity terminates in the activity of the body, and only through first arousing its activities can they begin to change those of the rest of the world. The body is the storm center, the origin of coördinates, the constant place of stress in all that experience-train. Everything circles round it, and is felt from its point of view. The word 'I,' then, is primarily a noun of position, just like 'this' and 'here.' Activities attached to 'this' position have prerogative emphasis, and, if functions have feelings, must be felt in a peculiar way. The word 'my' designates the kind of emphasis. I see no inconsistency whatever, in defending on the one hand 'my' activities as unique and opposed to those of outer nature, and on the other hand in affirming, after introspection, that they consist in movements in the head. The 'my' of them is the emphasis, the feeling of perspective-interest in which they are dyed.

and the subjectively felt activity would be seen to continue into objective activities that led far beyond. We thus acquire a habit, in discussing activity-experiences, of defining them by their relation to something more. If an experience be one of narrow span, it will be mistaken as to what activity it is and whose. You think that *you* are acting and you are only obeying someone's push. You think you are doing *this*, but you are doing something of which you do not dream. For instance, you think you are but drinking this glass; but you are really creating the liver-cirrhosis that will end your days. You think you are just driving this bargain, but, as Stevenson says somewhere, you are laying down a link the policy of mankind.

Generally speaking, the *ultimate outcome* of an activity is regarded by an onlooker as what it is more really doing; and *the most previous agent* ascertainable, being the first source of action, is regarded as the most real agent in the field. The others but transmit his impulse; on him we put responsibility; we name him when one asks us 'Who's to blame?'

But the most previous agents ascertainable, instead of being of longer span, are often of much shorter span than the activity in view. Brain-cells are our best example. My brain-cells are believed to excite each other from next to next (by contiguous transmission of katabolic alteration, let us say) and to have been doing so long before this present stretch of lecturing-activity on my part began. If any one cell-group stops its activity, the lecturing will cease or show disorder of form. *Cessante causa, cessat et effectus* — does not this look as if the short-span brain activities were the more real activities, and the lecturing activities on my part only their effects? Moreover, as Hume so clearly pointed out, in my mental activity-situation the words physically to be uttered are represented as the activity's immediate goal. These words, however, cannot be uttered without intermediate physical processes in the bulb and vagi nerves, which processes nevertheless fail to figure in the mental activity-series at all. That series, therefore, since it leaves out vitally real steps of action, cannot represent the real activities. It is something purely subjective; the *facts* of activity are elsewhere.

The real facts of activity that have in point of fact been sys-

tematically pleaded for by philosophers have, so far as my information goes, been of three principal types.

The first type takes a consciousness of wider time-span than ours to be the vehicle of the more real activity. Its will is the agent, and its purpose is the action done.

The second type assumes that 'ideas' struggling with one another are the agents, and that the prevalence of one set of them is the action.

The third type believes that nerve-cells are the agents, and that resultant motor discharges are the acts achieved.

Now if we must de-realize our immediately felt activity-situations for the benefit of either of these types of substitute, we ought to know what the substitution practically involves. *What practical difference ought it to make if*, instead of saying naïvely that 'I' am active now in delivering this address, I say that *a wider thinker is active*, or that *certain ideas are active*, or that *certain nerve cells are active*, in producing the result?

This would be the pragmatic meaning of the three hypotheses. Let us take them in succession in seeking a reply.

If we assume a wider thinker, it is evident that his purposes envelope mine. I am really lecturing *for* him; and although I cannot surely know to what end, yet if I take him religiously, I can trust it to be a good end, and willingly connive. I can be happy in thinking that my activity transmits his impulse, and that his ends prolong my own. So long as I take him religiously, in short, he does not de-realize my activities. He tends rather to corroborate the reality of them, so long as I believe both them and him to be good.

When now we turn to ideas, the case is different, inasmuch as ideas are supposed by the association psychology to influence each other only from next to next. The 'span' of an idea or pair of ideas, is assumed to be much smaller instead of being larger than that of my total conscious field. The same results may get worked out in both cases, for this address is being given anyhow. But the ideas supposed to 'really' work it out had no prevision of the whole of it; and if I was lecturing for the Absolute in the former case, so, by parity of reasoning, are my ideas now lecturing for me, that is, accomplishing unwit-

tingly a result which I approve and adopt. But, when this passing lecture is over, there is nothing in the bare notion that ideas have been its agents that would seem to guarantee that my present purposes in lecturing will be prolonged. *I* may have ulterior developments in view; but there is no certainty that my ideas as such will wish to, or be able to, work them out.

The like is true if nerve-cells be the agents. The activity of a nerve-cell must be conceived of as a tendency of exceedingly short reach, an 'impulse' barely spanning the way to the next cell — for surely that amount of actual 'process' must be 'experienced' by the cells if what happens between them is to deserve the name of activity at all. But here again the *gross* result, as *I* perceive it, is indifferent to the agents, and neither wished or willed or foreseen. Their being agents *now* gives me no guarantee that like results will recur again. In point of fact all sorts of other results do occur. My mistakes, impotencies, perversions, mental obstructions, and frustrations generally, are also results of the activity of cells. Although these are letting me lecture now, on other occasions they make me do things that I would willingly not do.

The question *Whose is the real activity?* is thus tantamount to the question *What will be the actual results?* Its interest is dramatic; how will things work out? If the agents are of one sort, one way; of another sort, otherwise as well. The pragmatic meaning of the various alternatives in short is great. It makes no merely verbal difference which opinion we take up.

You see it is the old dispute come back! Materialism and teleology; elementary short-span actions summing themselves 'blindly,' or far foreseen ideals coming with effort into act.

Naïvely we believe, and humanly and dramatically we like to believe, that activities both of wider and of narrower span are at work in life together, that both are real, and that the long-span tendencies yoke the others in their service, encouraging them in the right direction, and damping them when they tend in other ways. But how to represent clearly the *modus operandi* of such steering of small tendencies by large ones is a problem which metaphysical thinkers will have to ruminate upon for many years to come. Even if such control should eventually

grow clearly picturable, the question how far it is successfully exerted in this actual world can only be answered by investigating the details of fact. No philosophic knowledge of the general nature and constitution of tendencies, or of the relation of larger to smaller ones, can help us to predict which of all the various competing tendencies that interest us in this universe are likeliest to prevail. We know as an empirical fact that far-seeing tendencies often carry out their purpose, but we know also that they are often defeated by the failure of some contemptibly small process on which success depends. A little thrombus in a statesman's meningeal artery will throw an empire out of gear. I can therefore not even hint at any solution of the pragmatic issue. I have only wished to show you that that issue is what gives the real interest to all inquiries into what kinds of activity may be real.

I said a while back that I should return to the 'metaphysical' question before ending; so, with a few words about that, I will now close my remarks.

In whatever form we hear this question propounded, I think that it always arises from two things, a belief that *causality* must be exerted in activity, and a wonder as to how causality is made. If we take an activity situation at its face-value it seems as if we caught *in flagrante delicto* the very power that makes facts come and be. I now am eagerly striving, for example, to get this truth which I seem half to perceive, into words which shall make it show more clearly. If the words come, it will seem as if the striving itself had drawn or pulled them into actuality out from the state of merely possible being in which they were. How is this feat performed? How does the pulling *pull?* How do I get my hold on words not yet existent, and when they come by what means have I *made* them come? Really it is the problem of creation; for in the end the question is: How do I make them *be*? Real activities are those that really make things be, without which the things are not, and with which they are there. Activity, so far as we merely feel it, on the other hand, is only an impression of ours, one may say; and an impression is, for all this way of thinking, only a shadow of another fact.

Arrived at this point, I can do little more than indicate the

principles on which, as it seems to me, a radically empirical philosophy is obliged to rely in handling such a dispute.

If there *be* real creative activities in being, radical empiricism must say, somewhere they must be immediately lived. Somewhere the *that* of efficacious causing and the *what* of it must be experienced in one, just as the what and the that of 'cold' are experienced in one whenever a man has the sensation of cold here and now. It boots not to say that our sensations are fallible. They are indeed; but to see the thermometer contradict us when we say 'it is cold' does not abolish cold as a specific nature from the universe. Cold is in the arctic circle if not here. Even so, to feel that our train is moving when the train beside our window moves, to see the moon through a telescope come twice as near, or to see two pictures as one solid when we look through a stereoscope at them, leaves motion, nearness and solidity still in being — if not here, yet each in its proper seat elsewhere. And wherever the seat of real causality *is*, as ultimately known 'for true' (in nerve-processes, if you will, that cause our feelings of activity as well as the movements which these seem to prompt), a philosophy of pure experience can consider the real causation as no other *nature* of thing than that which even in our most erroneous experiences appears to be at work. Exactly what appears there is what we *mean* by working, though we may later come to learn that working was not exactly *there*. Sustaining, persevering, striving, paying with effort as we go, hanging on, and finally achieving our intention — this *is* action, this *is* effectuation in the only shape in which, by a pure experience-philosophy, the wherabouts of it anywhere can be discussed. Here is creation in its first intention, here is causality at work.[1] To treat this offhand as the bare surface of a world

[1] Let me not be told that this contradicts a recent article of mine, 'Does Consciousness Exist?' in the *Journal of Philosophy* for September 1, 1904 (see especially page 489), in which it was said that while 'thoughts' and 'things' have the same natures, the natures work 'energetically' on each other in the things (fire burns, water wets, etc.) but not in the thoughts. Mental activity-trains are composed of thoughts, yet their members do work on each other, they check, sustain, and introduce. They do so when the activity is merely associational as well as when effort is there. But, and this is my reply, they do so by other parts of their nature than those that energize physically. One thought in every developed activity-series is a desire or thought of purpose, and

whose real causality is a more solid way of action hidden in the cubic deeps, is for the more empirical way of thinking, only animism is another shape. You explain your given fact by a 'principle,' but the principle itself, when you look clearly at it, turns out to be nothing but a previous little spiritual edition of the fact. Away from that one and only *kind* of fact your mind, considering causality, can never get.[1]

I conclude then that real effectual causation as an ultimate nature, as a 'category,' if you like, of reality, is just what we feel it to be, just that kind of conjunction which our own activity-series reveal. We have the whole butt and being of it in our hands; and the healthy thing for philosophy is to leave off grubbing underground for what effects effectuation, or what makes action act, and to try to solve the concrete questions of where effectuation in this world is located, of which things are the true causes there, and of what the more remote effects consist.

all the other thoughts acquire a feeling tone from their relation of harmony or oppugnancy to this. The interplay of these secondary tones (among which 'interest,' 'difficulty' and 'effort' figure) runs the drama in the mental series. In what we term the physical drama these qualities play absolutely no part. The subject needs careful working out; but I can see no inconsistency.

[1] I have found myself more than once accused in print of being the assertor of a metaphysical principle of activity. Since literary misunderstandings retard the settlement of problems, I should like to say that such an interpretation of the pages I have published on Effort and on Will is absolutely foreign to what I meant to express. I owe all my doctrines on this subject to Renouvier; and Renouvier, as I understand him, is (or at any rate then was) an out and out phenomenist, a denier of 'forces' in the most strenuous sense. Single clauses in my writing, or sentences read out of their connection, may possibly have been compatible with a transphenomenal principle of energy; but I defy anyone to show a single sentence which, taken with its context, should be naturally held to advocate that view. The misinterpretation probably arose in the first instance from my defending (after Renouvier) the indeterminism of our efforts. 'Free will' was supposed to involve a supernatural agent. As a matter of plain history the only 'free will' I have ever thought of defending is the character of novelty in fresh activity-situations. If an activity-process is the form of a whole 'field of consciousness,' and if each field of consciousness is not only in its totality unique (as is now commonly admitted) but has its elements unique (since in that situation they are all dyed in the total) then novelty is perpetually entering the world and what happens there is not pure *repetition*, as the dogma of the literal uniformity of nature requires. Activity-situations come in short each with an original touch. A 'principle' of free will if there were one, would doubtless manifest itself in such phenomena, but I never saw, nor do I now see, what the principle could do except rehearse the phenomenon beforehand, or why it ever should be invoked.

From this point of view the greater sublimity traditionally attributed to the metaphysical inquiry, the grubbing inquiry, entirely disappears. If we could know what causation really is in itself, the only use of the knowledge would be to help us to recognize an actual cause when we had one, and so to track the actual causal operations out. The mere abstract inquiry into causation's hidden nature is not more sublime than any other inquiry equally abstract. Causation inhabits no more sublime level than anything else. It lives, apparently, in the dirt as well as in the Absolute, or as in man's unconquerable mind. The worth and interest of the world consists not in its elements, be these elements things, or be they the conjunctions of things; it exists rather in the dramatic outcome in the whole process, and in the meaning of the stages, which the elements work out.

My colleague and master, Josiah Royce, in a page of his review of Stout's 'Analytic Psychology' in *Mind* for 1897 has some fine words on this point with which I cordially agree. I cannot agree with his separating the notion of efficacy from that of activity altogether (this I understand to be one contention of his) for activities are efficacious whenever they are real activities at all. But the inner nature both of efficacy and of activity are superficial problems, I understand Royce to say; and the only point for us in solving them would be their possible use in helping us to solve the far deeper problem of the course and meaning of the world of life. Life, says our colleague, is full of significance, of meaning, of success and of defeat, of hoping and of striving, of longing, of desire, and of inner value. It is a total presence that embodies worth. To live our own lives better in this presence is the true reason why we wish to know the elements of things; so even we psychologists must end on this pragmatic note.

The urgent problems of activity are thus more concrete. They are all problems of the true relation of longer-span to shorter-span activities. When, for example, a number of 'ideas' (to use the name traditional in psychology) grow confluent in a larger field of consciousness, do the smaller activities still coexist with the wider activities now experienced? And, if so, do the wider activities accompany the narrower ones inertly, or do

they exert control? Or do they rather utterly supplant and replace them and short-circuit their effects? Again, when a mental activity-process and a brain-cell series of activities both terminate in the same muscular movement, does the mental process steer the neural processes or not? Or, on the other hand, does it independently short-circuit their effects? Such are the questions that we must begin with. But so far am I from suggesting any definitive answer to such questions, that I hardly yet can put them clearly. They lead, however into that region of pan-psychic and ontologic speculation of which Professor Bergson and our colleague Strong have lately enlarged the literature in so able and interesting a way. The results of these authors seem in many respects dissimilar, and I understand them as yet but imperfectly; but I cannot help suspecting that the direction of their work is very promising, and that they have the hunter's instinct for the fruitful trails. I earnestly recommend the study of their writings to the members of our two Associations.

THE RELATION OF PERCEPTIVE AND REVIVED MENTAL MATERIAL AS SHOWN BY THE SUBJECTIVE CONTROL OF VISUAL AFTER-IMAGES.

CONTRIBUTED FROM THE PSYCHOLOGICAL LABORATORY OF OHIO STATE UNIVERSITY.

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I.

The existence of mental content of these two sorts, is not in question here. Indeed, the fact of relation between them is not in question. There are mental processes which arise primarily by a stimulus coming to us from the environment, — stimuli impinging upon our sense organs, be they inner or outer, — and there are mental processes which seem to arise within the nervous system itself. In every act of perception also, no matter how simple it is, we seem to have involved, on the one hand an objective factor, and on the other what Professor James has called the 'ideational excitement.' There seems to be an interworking of these in every case of conscious mental acquisition. Herbart set forth the fact of this relation in his classic exposition of the apperceptive process. He showed the fact of their existence, but by his mechanical treatment of psychology he was unable to show how they coöperated in the production of new content. Professor James, in his discussion of 'The Intimate Nature of the Attention Process,'[1] gives the whole matter a very much more lucid description. 'Attentive' is in general applied to one who is experiencing, or perceiving, or cognizing, in a higher and more vivid fashion than ordinarily. Attention may therefore be assumed to exaggerate and bring into clear light the important factors in all cognition.

There are, even at the present time, recrudescences of Condillac's theory of attention. In fact the purposes of explanation are always served best where that which appears to be com-

[1] *The Principles of Psychology*, Vol. I, pp. 434 ff.

plex, can be shown to be simple. Could one see the essence of attention as a simple inpouring of new mental material aroused by the inpouring of stimuli, — as nothing more than the exclusive and excessive use of a given avenue of sense at a given time, this indeed would be in the service of science. Ribot and Lange, in placing the emphasis they do upon the motor adaptation, as constituting the essence of the attention process, emphasize the facilitation of the incoming stimulus, and make the so-called inner factor to consist wholly in a bodily preparation. But the inner factor is more than this. It is something independent of and separate from the adaptation of the sense organ. Lange[1] maintains that the anticipatory preparation, from within, of the ideational centers, is the result, simply and solely of the motor adjustment. He would go even so far as to maintain that all imagination depends upon motor adjustment. And thus all so-called centrally-aroused mental processes are nothing more than sensations from motor organs, and the resultant feelings. This may be a too liberal interpretation of the author, but it flows from his view. It is an aim in the right direction, as it seeks simplicity; but it goes far beyond, and even contrary to, the facts. That imagination and all centrally aroused mental processes are not solely the product of motor adaptation, can be asserted unqualifiedly. That some of them are so aroused we will grant. For some mental types it may be that all are so aroused; but this is certainly not true for others. It is a hasty generalization to claim that they are. We may have motor adjustment without attention. But it may still be urged that the inner adjustment is a resultant of the motor adjustment; that it is lacking in these cases simply because the outer adjustment process fails to proceed to its natural development. But where this is a fact it already indicates that the two are less nearly the same process than they were claimed to be. And this relation is no longer thinkable when we realize the reverse fact, that we may have the ideational preparation of attention, or the revival of content without the innervation of any muscles. At least, in many persons of other than the muscular type, it seems not only possible, but the normal process, to be attentive to intellec-

[1] *Philosophische Studien*, 4: 413 ff.

tual processes without any muscular contractions, and consequently without any directly aroused kinæsthetic sensations. We think it highly probable however that there are revived kinæsthetic sensations present.

It is also highly probable that these and all revived mental processes bear a much closer relation to the physical basis of the original processes of which they are the revival, than is commonly supposed. It may even be that the peripheral sensory neurons are involved, — that the difference between this revived process and the original is really one of accompanying processes. If this is true, it is at once evident that the contentions of both sides in the attention debate are right. There may be cases of subjective attention where the objective factor is wholly represented by incipient motor processes which however fail to become anything more than tendencies to action, and so they pass for cases of attention without motor adjustment. And there may be cases of attention where the motor processes are the cue for the centrally aroused processes. The whole matter of the relation of the peripherally aroused and the centrally aroused or revived mental processes is in a very unsatisfactory state. The voluntary control of after-images offers a means of studying the relation between a centrally initiated and a peripherally aroused process.

There are four distinct lines of observation bearing on this line of work, as follows:

1. Vivid visualization of memory images.

2. Control of the color and form of idio-retinal light.

3. After-images of memory images of color, or of subjectively induced color.

4. Control of the color of visual after-images.

1. There are many classic instances of vivid visualization of color, and discussions of their relations to the so-called spectral illusions, to visual hallucinations, and to dreams proper. Notable amongst these is the account of his own experience given by Sir Isaac Newton in a letter to John Locke. This account has contained so much of suggestion for the present investigation that we shall quote it in part. Newton looked upon the image of the sun in a mirror, for a very short time, with his

right eye, and then turned his eyes toward a dark corner to observe the decay of the after-images. He says: "This I repeated a second and third time. At the third time, when the phantasm of light and colors about it were almost vanished, intending my fancy upon them to see their last appearance, I found, to my amazement that *they began to return, and by little and little, to become as lively and vivid as when I had newly looked upon the sun;* but when I ceased to intend my fancy upon them, they vanished again. After this, I found that as often as I went into the dark, and intended my mind upon them, as when a man looks earnestly to anything which is difficult to be seen, *I could make the phantasm return*, without looking any more upon the sun, and, *the oftener I made it return, the more easily I could make it return again.* And at length, by repeating this, without looking any more upon the sun, I made such an impression upon my eye, that if I looked upon the clouds, or a book, or any bright object, I saw upon it a round bright spot of light, like the sun, and, which is still stranger, *though I looked upon the sun with my right eye only, and not with my left, yet my fancy began to make an impression on my left eye*, as well as upon my right: for if I shut my right eye, and looked upon a book or the clouds with my left eye, I could see the spectrum of the sun almost as plain as with my right eye, if I did but intend my fancy a little while upon it. * * * And now, in a few hours' time, I had brought my eyes to such a pass that I could look upon no bright object with either eye, but that I saw the sun before me, so that I durst neither write nor read, but to recover the use of my eyes, shut myself up in my chamber, made dark, for three days together, and used all means to divert my imagination from the sun." By this means he began to recover the use of his eyes in three or four days. "But for some months," he says, "the spectrum of the sun began to return as often as I began to mediate upon the phenomena, even though I lay in bed at midnight with my curtains drawn."[1]

[1] This letter is given in full in King's *Life of Locke*, 1830, Vol. I., p. 40; also quoted by Sir David Brewster, *Quarterly Review*, July, 1831, 45: 341–358.

We have to do here with a strong after-image and also a very vivid memory image. It is an after-image in the early stages. It comes back involuntarily when the retinal illumination is changed, as when he looks at a cloud or a book. After-images may also be shifted from one eye to the other. This though is not a means of identifying an after-image. This behavior of after-images may really be a point of close connection between them and memory images. It is certainly a matter of the voluntary control of the after-image. Revived processes play a part in the phenomenon. Newton's description is also clearly of a memory image. His phrase 'intending my fancy upon it' is very aptly descriptive of the process of voluntary revival and intellectual attention. This 'intention of the fancy,' or direction of the attention, upon a strong retinal impression (this includes the after-image) greatly increases the vividness of the latter — brings it into great prominence in the life of the mind, and makes it far more liable to recall.

Goethe's experience of the constantly unfolding rosette, which he saw every time he closed his eyes and bent his head forward, is a case of a habitual connection between a position and a memory image. The position was the cue to set it going. It would constantly throw out new petals of different colors, but mostly red, as long as he cared to watch it. A Mrs. Haweis, one of Mr. Galton's correspondents, as a child, when it was dark, saw a flight of pink roses floating in a mass from left to right, which presently changed to a flight of sparks or gold speckles.[1] These are both cases of automatized memory images. They have started in some more or less accidental way, which the person no longer knows about. Children have many more of these vagrant images than do adults. Of the specifically willed images, those of the Bushmen drawing animals are in point.[2] They carefully place several dots, and then rapidly fill in the sketch. They evidently have a mental picture before the mind's eye.

Strong visualizers can project their mental pictures, and it sometimes becomes difficult for them to distinguish this vivid

[1] *Human Faculty*, p. 159.
[2] Galton, *Human Faculty*, p. 103.

mental imagery from the real world. More frequently though the mental image, projected, seems transparent like the reflected image from plain glass, and the real is seen through it, as the transmitted is through the reflected image. It is as if the mental image were seen in a lustrous surface through which the landscape was visible. Like the illusion of movement in Fleischl's waterfall experiment, in a way it is there, and in another way it is not there. In a way it seems real, and in a way it does not seem real. In so far as we distinguish it from the real, it is merely mental imagery; and in so far as it seems real it is hallucination.

This power of visualizing the form and color of objects, real or imagined, is one capable of cultivation. It increases rapidly when attention is directed toward it. A little systematic effort will convince anyone of the truth of this statement.[1]

2. As a more restricted field, but at the same time a part of the group of phenomena considered, we are especially interested in what Professor Ladd has called the "voluntary control of the 'Eigenlicht.'"[2] Professor Ladd, finding that the light of the retina assumed various and peculiar forms, in his case, without effort on his part, set about trying what he could do voluntarily to modify the form and the color. "This power grew rapidly, with continued practice; that is to say I was soon able, by attentively willing (compare Newton's 'intending his fancy'), for perhaps some three to five minutes, to cause a cross or a circle, or two concentric circles or some other simple figure, to appear in the retinal field." The method was simply to close the eyes, wait till all after-images had died away, and then persistently and attentively *to will* that the color mass caused by the 'Eigenlicht' should take on some particular form or should change in color. A number of students who took up the experiment at Professor Ladd's suggestion had very good success in both of these lines. It seems that any one can get some power of calling up colors and forms at will, by persistently trying to do so.

[1] See Galton, *Human Faculty*, pp. 109 and 106. See also James, *Principles of Psy.*, II., p. 66; F. Meakin, *Harvard Psy. Studies*, I., pp. 235–275; and C. S. Moore, *Harvard Psy. Studies*, I., pp. 277–306.

[2] *Direct Control of the Retinal Field*, G. T. Ladd, PSYCH. REV., 1: 51–355.

3. There are several records of visual after-images (negative and complementary) of forms and colors, which themselves have been induced voluntarily and without external stimuli, as in the cases just cited. The color, having been induced by subjective control, and then being allowed to take free course, runs into a complementary stage. G. H. Meyer [1] says that most of his subjectively induced colors, when bright, left after-images behind them when the eyes were quickly opened during their presence. Some of Ladd's students observed the same phenomenon. Binet and Féré [2] find that the persistent idea of a color develops into its complementary.

Complementary after-images of hallucinatory color impressions, induced in the hypnotic state, have been reported frequently. It is claimed that an hallucination of a red star, for example, is followed by a green after-image of the same form, and that this follows without any suggestion whatever from the hypnotizer. But this relation must, as yet, be regarded as decidedly doubtful. It is of less weight than that furnished by normal subjects. If, in either case, there is any hint of the probability of the complementary color succeeding the induced color, this would be induced as certainly and as easily as the first color. Both alike would be subjective, meaning by that non-retinal, in origin. The hypnotic subject is more liable to this than the normal because of his abnormal suggestibility. He may take a suggestion without either himself or the hypnotizer suspecting it.[3] Even Charcot was led to suppose that some of the fulfillments of his own expectations were a part of the natural process, to the extent of falling into error in description and classification of hypnotic phenomena.

If however the complementary color impression arises independently of either suggestion or volition, it at once constitutes a close connection between the memory image or induced subjective color impression, on the one hand, and the sensory source of the original experience of which this is a revival, on the other hand. For the after-image is proved to be an affair

[1] Quoted in James' *Principles*, II., p. 67.
[2] *Animal Magnetism*, p. 254.
[3] See *Animal Magnetism*, Binet and Féré, p. 253.

of the sense-organ — of the peripheral visual apparatus. If, then, the so-called after-image of the subjective memory image (imagination product) is really a physiological consequent of the subjective memory image (or rather of the physiological processes which lead up to it), as the regular visual after-image is the physiological consequent of the visual processes which lead up to the visual sensation, of which it is an after-image; then the subjective memory image would seem to involve retinal processes as part of the neural apparatus for its production. Anything which will prove or disprove the non-volitional character of this so-called after-image of the memory image, is then of decided importance in the question of the relation of sensational and revival processes.

It was for the purpose of meeting this situation that Miss Downey worked with her *naïve* subject. This subject had excellent power for visualizing color, could control the images well, and could project them. She was entirely ignorant of the complementary relations of colors of sensations and colors of after-images. She was also entirely in the dark as to the purpose of the experiments. In eighty per cent. (80 per cent.) of her trials the after color was the complementary of the induced color which it had succeeded. [1]

4. Miss Downey says that her subject did not believe she could change the course of an after-image voluntarily, and that she herself has never been able to do so. This is however improbable, as a consequence of her own experiment. We do not impugn her good faith in making the statement. But if one can create vivid color impressions and experience after-images of these, which bear the same relation to them that the ordinary visual after-image bears to the sense impression, it seems highly probable, as urged above, that the same retinal processes are involved in both the ordinary after-image and the subjectively aroused or memory process. If this is the case they ought to interfere with each other when it is attempted to carry them on simultaneously. It ought to be possible to interrupt and change the course of an after-image by voluntarily arousing subjective

[1] 'An Experience in Getting an After-image from a Mental Image,' PSYCH. REV., 8: 42.

colors. In other words it ought to be possible, if the above reasoning from the observed facts is correct, to *control* the course of the visual after-image, that is, to alter, voluntarily, its natural course.

Miss Washburn[1] found quite a considerable modification of the normal 'flight of colors' was produced by an effort persistently to see a given color through the course of an after-image. It was not possible to wholly submerge the regular colors of the after-image, but the color 'tried for' prevailed much more than when no effort was made. The subjects were practised until they obtained a fairly uniform course of color at each successive trial. They were then told to try hard to drown out the other colors by thinking persistently of a given color. With three of the subjects the traces of the color striven for were intensified and were held longer than in the normal after-image, and they also came sooner. With the other subject, who was an exceptionally good visualizer, the color striven for was held almost without interruption throughout the time of the after-image course.

II.

In view of the doubt that seems to prevail as to whether the course of the after-image can be altered or interfered with by mental imagery, it is worth while to look for further evidence on the question. And especially, in view of our ignorance as to the nature of the interference, if there is such, did it seem worth while to make further experiments along lines similar to some already reported. Our special desideratum was knowledge of the processes of the memory image, on the one hand, and of the after-image, on the other hand, that we might see the relations between them. In other words, we wanted to know how the 'ideational preparation' of the attention impinges upon and modifies the sensory process. In the case of the after-image we have a unique process. The peripheral apparatus keeps on sending in nervous disturbances, which arouse sensations, long after the external stimulus has been withdrawn, so that the possibilities of an even division of the attention between the memory image, which is called up voluntarily, and the peripherally

[1] 'Subjective Colors and the After-image,' *Mind*, N. S. (1899), 8: 25–34.

aroused process, is very much easier than it is in the case where the peripherally aroused process is caused directly and immediately by an external stimulus. This is for the simple reason that we have to attend to the after-image in very much the same way that we attend to the memory image, whereas the sensation proper makes a much more forcible entrance into the focal region of consciousness. It is more compelling in its power over attention.

After the first preliminary work, which was directed to ascertaining whether there was a fair degree of constancy in the course of the after-image, we proceeded on the following plan: Each day we gave (1) a series of two to six normal after-images, usually with a twenty-second exposure, then (2) about two memory images, or subjective controls for a given color, beginning when no after-image effects were present, and then (3) two or more subjective controls, for a given color, of the after-image, this after-image being aroused in precisely the same way as the normal after-image. We found it necessary to have all these three kinds of experiment performed each day, in order to have a valid ground of comparison, for the different light conditions on different days led to very different color courses and lengths of courses in the after-image. This plan of procedure enables us to see, side by side (1) the simple after-image effect, (2) the simple memory image (imagination product) and then (3) these two combined.

The work was done in a dark room. The stimulus for the after-images was daylight admitted through a window, measuring 36 × 38 centimeters. This window was high up above the floor of the room so the subject, from his position, saw only the sky or clouds. A sliding shutter, with pulley attachments, made it possible to regulate the time of exposure very accurately. Some bars crossed the window, making it easier to follow the course of the after-image. The subject sat facing the window about six meters distant. The experimenter sat directly under the window, with his back to the subject. He worked by a small hand electric lamp, closely shielded in a box. The subject usually turned his head to another part of the room and closed his eyes, when observing an after-image. We do not

think our results were impaired by the small amount of light present, but of course absolute darkness would be preferable, as that would remove all doubt. Telephonic connections or an automatic recording apparatus would remove all necessity for light in the room where the observations were being made. An automatic recorder would be of further use in that it would make possible a more accurate transcription of the actual color changes. The subject himself finds it impossible to speak of all the changes, those he does speak of are already past when they are mentioned, and the experimenter may get them recorded for a still later time. Two reaction times enter into the error. Of course these hold alike of all records, and so their comparative value is not impaired. And they are used only comparatively here. An automatic recorder with receiving apparatus furnished with pressure taps for four or six colors, arranged in spectral order, would greatly facilitate work in this field.

The exposures were mostly of twenty seconds. In order to avoid fatigue, we usually changed off, experimenter becoming subject and vice versa, every fifteen minutes. And ample time was allowed in every case between experiments for the complete disappearance of the effects of the previous after-image.

Neither of us are exceptional visualizers. H. has always depended about equally upon the visual sense and the vocal muscular sense for the verification of spelling. When, a few years ago, as a beginner in psychology, his attention was first drawn to the work of Francis Galton on mental types, he found great difficulty in recalling the face of a near friend. The result of efforts at visualization were very disappointing. It seemed that objects of such worth must of necessity occupy a more prominent place in the visual imagination than that which this test revealed them to hold. As the visual attention was turned upon these thought objects, they seemed to vanish as do faces seen in clouds, or cliffs, or the moon, when they are closely scrutinized. But this power steadily improved, and H. can now visualize faces with ease, and can get a fair wealth of detail.

W. has always had a fair visual memory, being able to

remember dates, definitions, etc., best by having a visual image of a page or list of names. He had little difficulty in calling up the faces of friends. The visual image of a person was usually called up by the name of the person and was always connected with familiar circumstances. But these recalls were always very literal reproductions of the original experience. For example, he had seen Mr. Moody preaching and could easily see him in that position; but if he tried to see him in his study or at a hotel, it was no longer Mr. Moody. The image was very indefinite and unlike the original. When W. was about fifteen years of age, he often saw as he lay in bed, in the dark, 'flights of color.' These always had the same elliptical shape (about three inches by two) with an irregular, colorless spot occupying the center. This figure and these colors appeared about eighteen to twenty inches distant from his eyes. The phenomenon was of accidental origin, so far as W. is aware, and would appear and disappear of its own accord. But he was soon able to start it at will. When once set going, though, it went through its usual course. After a few months, this experience was lost sight of. It was recalled since he began working with after-images. But he cannot reproduce the figure, as he then had it.

This experience indicates a natural facility in W. for visual imagery. But since beginning this work, he has noticed a marked increase in this facility. His images are now more life-like, and he has no difficulty in calling up images of any familiar experience, such as a person or a landscape. Further he now has control of this imagery, so that he can see a familiar person in a situation very foreign to the person in question, such as the President of the university firing an engine or ascending in a baloon, things which he has never known him to do.

The charts presented herewith are reproductions of the courses of after-images, normal and controlled, and of controlled memory images. The principal object in view in presenting those on Chart I. is to show samples of the very early after-images. V., VI., VII., VIII., and IX. show a close similarity. These of February 24 show a marked increase in regularity over those of Feburary 10; though even these earlier ones are

by no means without similarity. The improvement is probably an improvement in the power of observing this species of phenomena. Chart II. shows, side by side, the normal after-image, the controlled after-image, and the controlled memory image or the voluntary revival and retention of color sensation, one series being by H. and one by W. In making up these charts as well as in making up the tables of averages it was necessary to adopt some arbitrary way of treating such colors as violet and orange, both for the purpose of simplifying the work of reproduction in the charts and in order to bring the summary statement of the results into a reasonable compass. The following compositions were adopted: Purple = two thirds red and one third blue, violet = two thirds blue and one third red, blue green = one half blue and one half green, orange = one half red and one half yellow, green yellow = one-half green and one half yellow.

The chief objection to this is that there is no means of distinguishing when these colors appear separately in different parts of the image and when they represent colors the same all over the field. But two simultaneous colors were comparatively infrequent. Spaces left without color indicate times when the image was colorless or had vanished from the field, temporarily or finally. The numbers at the left side of the charts represent seconds from the time of the beginning of the image.

TABLE I.

Name of Observer	W.	H.
Total Number of normal after-images observed	91	92
Average total time of the course of the normal after-image	171[1]	213
Average total time of *yellow* in the normal after-image	13	18
Average total time of *red* in the normal after-image	7.5	31.7
Average total time of *green* in the normal after-image	22	30
Average total time of *blue* in the normal after-image	42	75
Total number of controlled after-images	47	46
Average total time of the course of a controlled after-image	226	317
Number of after-images controlled for *blue*	19	23
Average total time of *yellow* in after-images controlled for *blue*	13	12
Average total time of *red* in after-images controlled for *blue*	6	28.6
Average total time of *green* in after-images controlled for *blue*	21	24.5
Average total time of *blue* in after-images controlled for *blue*	108	190
Number of after-images controlled for *green*	7	5

[1] Time is always given in seconds.

TABLE I.—*Continued.*

Name of Observer	W.	H.
Average total time of *yellow* in after-images controlled for *green*..	20	20
Average total time of *red* in after-images controlled for *green*.....	16	27.6
Average total time of *green* in after-images controlled for *green*...	133	168
Average total time of *blue* in after-images controlled for *green*.....	21	66
Number of after-images controlled for *red*.....	6	7
Average total time of *yellow* in after-images controlled for *red*.....	7.4	28
Average total time of *red* in after-images controlled for *red*.....	147	212
Average total time of *green* in after-images controlled for *red*.....	57	23
Average total time of *blue* in after-images controlled for *red*.....	25	90
Number of after-images controlled for *yellow*.....	15	11
Average total time of *yellow* in after-images controlled for *yellow*	45	102
Average total time of *red* in after-images controlled for *yellow*.....	10.6	22.6
Average total time of *green* in after-images controlled for *yellow*	36	18.5
Average total of *blue* in after-images controlled for *yellow*.....	30	53.6
Number of memory images controlled for *blue*.....	3	3
Average total time of *yellow* in memory images controlled for *blue*	14.5	16.6
Average total time of *red* in memory images controlled for blue...	5.6	24.6
Average total time of *green* in memory images controlled for *blue*	0	24.8
Average total time of *blue* in memory images controlled for *blue*..	123	228
Number of memory images controlled for *green*.....	4	4
Average total time of *yellow* in memory images controlled for *green*.....	5.5	15.6
Average total time of *red* in memory images controlled for *green*.	16	20
Average total time of *green* in memory images controlled for *green*	62	134
Average total time of *blue* in memory images controlled for *green*	10.5	60
Number of memory images controlled for *red*.....	6	6
Average total time of *yellow* in memory images controlled for *red*	5.7	16
Average total time of *red* in memory images controlled for *red*...	99	172
Average total time of *green* in memory images controlled for *red*.	79	16
Average total time of *blue* in memory images controlled for *red*...	31	29
Number of memory images controlled for *yellow*.....	6	4
Average total time of *yellow* in memory images controlled for *yellow*.....	93	161
Average total time of *red* in memory images controlled for *yellow*	27	23
Average total time of *green* in memory images controlled for *yellow*	18.6	38
Average total time of *blue* in memory images controlled for *yellow*	33	16.5

TABLE II.

	Blue.		Green.		Red.		Yellow.	
	W.	H.	W.	H.	W.	H.	W.	H.
Total time of color in normal after-image.	42	75	22	30	7.5	31.7	13	18
Total time of color in after-image controlled for *blue*.	**108**	**190**	21	24.5	6	28.6	13	12
Total time of color in memory image controlled for *blue*.	**123**	**228**	0	24.8	5.6	24.6	14.5	16.6

TABLE II. — *Continued.*

	Blue.		Green.		Red.		Yellow.	
	W.	H.	W.	H.	W.	H.	W.	H
Total time of color in after-image controlled for *green.*	21	66	133	168	16	27.6	20	20
Total time of color in memory image controlled for *green.*	10.5	60	62	134	16	20	5.5	15.6
Total time of color in after-image controlled for *red.*	25	90	57	23	147	212	7.4	28
Total time of color in memory image controlled for *red.*	31	29	79	16	90	172	5.5	16
Total time of color in after-image controlled for *yellow.*	30	53.6	36	18.5	10.6	22.6	45	102
Total time of color in memory image controlled for *yellow.*	33	16.5	18.6	38	27	23	93	161

A summary of the work of H. and W. is presented in Table I. This is the result of a very careful and complete analysis and averaging of 183 normal after-images, 93 controlled after-images, and 36 controlled memory images. One of the first things that strikes one as he looks at our scores of charts, or at this table, is the considerable increase of the total time of the controlled after-image over the normal. The latter increase the time about 70 per cent. in each subject. This longer time of the controlled image may be in part due to the engrossing of the attention in the work of distinguishing and holding the desired color, so that the time of the disappearance of the after-image is not noticed. In fact H. often reported, in the case of the normal after-image, that he no longer had an after-image,— that he now knew it was not present because he could move his eyes without affecting the image, but he did not know when it left. Its departure was not signalized by any observable change, but now that his arrested attention was turned to it he knew that it was not an after-image. If this was possible where the attention was directed wholly upon the after-image, it would be much more likely to happen when the attention was divided between the observation of the after-image and the revival of a color. W., however, never had this difficulty. He knew very clearly when the after-image proper was at an end. The lengthened time in his case then shows the effect of attention upon the after-image. It lengthens its life. We both feel

that this is the effect of attention directed to the after-image, independently of these objective results and this interpretation of them. Of course the factor that lengthens the after-image for H. by causing him to mistake a memory image for it, is ultimately the same as that attention factor which lengthens it for W. For the memory image which H. projects and mistakes for the after-image, because it is so vivid and his attention is not critical of the source of his experience, is created by this very activity of attention, which is one of the factors in the perception of the after-image. Having the attention more actively aroused, means the prolongation of the after-image, and with a little more arousal still, it seems possible to bring up a vivid substitute which may be mistaken for it. This relation of the after-image and the memory image must be taken up in the final section of the paper; but this much of the way seems to be pointed out in the pursuit of the question immediately raised by the lengthened course of the controlled after-image.

The point at which anyone shall conclude that his after-image has ceased and a memory image begun, is, it seems to us, a matter depending upon that person's experience in the comparison of these two kinds of mental contents. Probably both the subjective and objective factors are operative in all cases of mental activity of any sort. Those in which the subjective factor predominates are called subjective, and those in which the objective factor predominates are called objective. And on the border-land, as in these cases of the controlled after-image, it is a matter which will vary from individual to individual as to which he shall call objective and which subjective. Without some such special experience as afforded by these experiments, these two realms remain comparatively widely separated from each other; and it serves the purposes of life that they do. But such experience as we have had in this work tends to fill in the normal gap between them with a series of experiences, hardly different in themselves, and yet approaching both sides of the gap. In such conditions it is often difficult to know when the limit is reached. In fact in these experiences we find, as we expected to find, a very intimate interworking of the objective and subjective factors; and

this is one reason at least for the lengthening of the after-image when it is controlled.

This greater total time of the controlled image is the reason for the greater total time of a given color, in some cases, in the controlled image, even when another is controlled for, than in the normal after-image. As an extreme case, H. has yellow in the normal after-image only 18 seconds, while in the after-image controlled for red he has yellow for a total of 28 seconds (see Table II.). This increase is about proportional to the increase of the total time of the after-image when controlled. The same factor is operative, of course, in the increase of the time of the color controlled for; but the increase is so much greater in any and all of these cases that there can be no question but that there is another factor at work here. Take *e. g.*, the case of the increase of red in the image controlled for red whose amount of yellow was just now cited, and it is seen that the average amount of red has increased from 31.7 seconds in the normal after-image to 212 seconds in these controlled for red, in the case of H. So it is in the case of any color controlled for. The increase is so significant that there can be no doubt that the voluntary control is a very important element in *bringing in* the color in question.

In looking at the results as they are presented in Table II. (which is simply another form of some of the results shown in Table I., arranged with a view to comparisons of the sort made above) the question arises as to whether the color, complementary to the one controlled for, comes into any greater prominence than the other two. If red is the color controlled for, will green be more prevalent than in the cases where blue, for example, is controlled for? A glance at the table shows us that H. has less of the complementary of the color controlled for in every case, than he has of the same color in the normal after-image, while W. has relatively less of yellow in images controlled for blue and of blue in images controlled for yellow than in the normal after-images. There is an increase of red in images controlled for green and of green in images controlled for red. But there is also an increase of yellow in images controlled for green and of green in images controlled for yellow.

These increases are however not large enough to signify the influence of any special relation of green and yellow. It would seem, too, as though the above hint at a relation is not borne out in other parts of the table.

In comparing the average total times of a given color, in the after-image controlled for that color, and in the memory image controlled for that same color, we find a curious relation brought out. Green and red are each decidedly less in the memory image controlled for those colors respectively than in the after-images controlled for the same colors. In red we find the after-image at 147 and 212 seconds while in the memory image it is 99 and 172 seconds. Just the reverse holds in the cases of yellow and blue. Here the time of the color in the memory image is greater than in the after-image, and about as much greater as red and green are less. It seems more difficult to hold, subjectively, green and red than it is to hold, subjectively, yellow and blue. The interchange of these two colors between themselves, when one of them is being controlled for in the memory image, is more marked than it is with blue or yellow. The predominance of the complementary green in both controlled after-image and controlled memory images is well shown by the last four series on Chart II. (VIII., IX., X., and XI.), in all of which the control is for red.

Table III. presents results obtained from three other subjects, of the same general nature as the results from W. and H., but of a more preliminary nature. They seem worth presenting for the special reason that two of these subjects were especially poor visualizers at the start of their work, and yet present good evidence of a control over their after-images. One of these, M., described the memory image he had of blue as being 'like the fading blue after-image about a minute after the image had gone.' He as well as D., claimed never to have seen color in their memory images. Both of them are of the motor type. These subjects, though, both of them, show a marked increase in the average total time of every one of the four colors in an after-image controlled for the given color over the average total time of the same color in the normal after-image. This clearly indicates a power of subjective control in

TABLE III.

	Observer.	Average Total Time in Normal After-Image	Average Total Time in After-Image Controlled for Blue.	Average Total Time in After-Image Controlled for Green.	Average Total Time in After-Image Controlled for Red.	Average Total Time in After-Image Controlled for Yellow.
Blue.	D.	75.2	90			27.5
	M.	42.5	70	32.5	35	40
	Mc.	7.5		20	2.5	0
Green.	D.	14.2	5			19.4
	M.	17.8	25	46.5	10	20
	Mc.	7.5		85	5	0
Red.	D.	35.6	12			10.1
	M.	12.5	15	4	20	15
	Mc.	26		35	92.5	55
Yellow.	D.	20.9	10			50.6
	M.	16.7	0	10	25	20
	Mc.	11		0	12.5	10
Total No.	D.	4	1	0	0	4
	M.	6	1	2	1	1
	Mc.	4	0	1	2	1

cases where there is a minimum of the visual ideational factor in ordinary imagery.

III.

It seems very clear from these various lines of proof that there is an interference of the after-image and the memory image with each other. This also seems very clear to us from our experience with the work. W. felt that his effort to get an effective subjective control of an after-image led to bringing that control color up from *behind* the after-image. It started in a small area and spread out over the area of the after-image. Other colors tend to come in, presumably the colors proper to the normal after-image. There is a continual struggle, as long as the natural course of the after-image, between the color which one is trying to hold in the field and these other colors which are described as 'trying to assert themselves.' The two elements are competing for the same field. This effort to get and keep a given color in the field is a very distinct species of mental work. This is about equally true whether one is controlling an after-image or is trying to hold a given color against chance comers, — memory images. It is as distinctly work as if one should try to lift himself up out of a chair.

With H., the color, which he is trying to have control (suppress) the after-image, often comes as a halo around the after-image, and gradually closes in on it. It closes it out of existence. Other times the color desired comes as a spot of color of very indefinite outlines, off to one side of the after-image. This he may succeed in placing upon the after-image. Or he sometimes was able to change the visual attention from the one field to the other. In many cases the control color "blotted out" the after-image, form and color. Other times the control color came in on the form of the after-image. It is a clear case of competition for both of us.

But with the fact of interference established, the really interesting question first comes prominently into view. This, as already stated, is the question of explanation. What is the nature of this interference? This of course involves a knowledge of the nature of the processes themselves. And a very natural way of approach to this question is to inquire about the physical basis of these processes. This line of inquiry has been pursued very often. Brewster adopted it to explain spectral illusions, and such phenomena as that which Newton describes. He says it is 'a retransmission along the optic nerves to the retina' by which the retinal elements are again excited, and the image is had over again. And he could get a memory image of St. Paul's, of sufficient vividness to blot out the landscape which was before his wide open eyes, simply, as he thought, by this centrally aroused stimulation of the retina. Probably this explanation takes its rise in the feeling, which is very pronounced in such cases of strong and vivid memory images, that the image is a product of ones own willing. From this feeling that one is making it himself, it seems a very easy, and indeed natural, inference that the peripheral process is the result of some energy set free in the retina by an efferent stimulation of some sort.

There are efferent fibers in the optic nerve, known to be such, both from the relative position of axis cylinder and cell body, and from the particular connections in the central nervous system. It is quite possible that these fibers function in such a way as to stimulate the peripheral sensory neurons. And if so we have herein the mechanism of the revival process. The

mechanism, whatever it is, not only serves for the production of spectral illusions, pseudo-hallucinations, and the more vivid species of memory images. For there is only one species of revival. The causes of revival are indeed many. But the mechanism of the process itself must be one and the same. And if this is the *modus operandi* of revivals of this more vivid sort, it is also the way of revivals of every sort. It is highly probable that all revival involves the functioning of the peripheral sensory apparatus, to some extent. It will at once be said that this is certainly not an essential condition of revival. For the blind by accident, who lose their retinæ entirely, no more lose the power of visual revival than does the patient who has lost a leg by amputation lose the power of reviving the muscle and joint sensations which he formerly had from that member. To this we simply say that the cases of the blind who have lost their whole peripheral sensory visual apparatus are worthy of very careful psychological investigation. The chances are that some important discoveries with regard to the nature of the revival process await us here. And further that there is undoubtedly a vicariousness in the nervous system by which processes are pared down. Part processes are left out. Nature is always making short-cuts. In this way it may be that the *tendency* to discharge toward the peripheral apparatus, there to set up the revival of the sensory process, is sufficient in itself to engender in the central (cortical) sensory cells a process which stands for the revival of the sensory process. It is a *symbol* of a copy.

From introspection we find that this *symbol* of revived sensory experience is further removed in kind from the genuine revival of a sense image, than is the latter from the sense-image itself. This is what we should expect if our theory of their origin is correct. W. calls them memory images and visual images, respectively. The former (symbols of copies) do not have any color. They are the images most of us have when we are engaged in conversation, and do not have time to get good visual or other sensory images of all the objects mentioned. They are the images which our subjects D. and M. have at their best, when they are trying hardest to get visual

images. They cannot get what W. calls visual images. The after-image, the vivid sensory image, and the ordinary memory image constitute in fact, a series of psychic processes which grade into each other. They differ among themselves in the nature of the interplay of the peripheral and central factors, and the relative importance of each, as suggested above.

The difference between sensational content and revived content, is not merely difference in intensity, as Hume said. It is probably, in part at least, a difference in content itself, as suggested already. It is also well known that memory of an experience is not the mere revival of that experience. If it were merely the experience over again it would not be *recognized* as that former experience. Psychologically considered, the difference between the sensational and revived processes is one of the *organization* of the processes within themselves, rather than of the impetus of the nerve current along any particular channel. Our whole view of the nature of psychical processes has very much changed since Hume. The concept of vividness is a very important aid to the explanation of such a difference as this now under consideration.

Vividness is indeed another name for the organization obtaining in experience. We commonly mean by it that emphasis which a mental process or an experience gets by the direction of attention toward that part of the field of consciousness. The common illustration of the watch ticking and being unnoticed as long as we are occupied with other things, but coming into prominence so soon as we turn our attention to it, is a good one. The loudness of the tick is the same all of the time. But the inner factor changes. That which was 'fringe' now becomes focal in consciousness. More of the energy of attention is directed toward it, and so it occupies a relatively more important place in the field.

The difference between a sensational experience and a memory of it is largely a matter of the changed vividness of many of the part processes involved. As Dr. Sidis[1] expresses it, in characterizing the difference between perception and hallucination, there is a difference in the *nucleus* in the two experiences.

[1] PSYCHOLOGICAL REVIEW, XI., pp. 15-29 and 104-137.

The changed vividness of elements changes the mental center of gravity, placing the emphasis on a new part of the experience. Parts which were focal before, are now in the fringe, and the present focal elements were previously fringe elements. This, at least, is one important species of change which occurs as the sensation becomes memory. Of course there is also the possibility of an actual change of the content, as contemplated above. Some elements may wholly drop out, and other new fringe elements may be brought in. It seems that recognition of the reproduced mental content is largely dependent upon such fringe elements.

The criticism of Hume's psychology inheres in part in all attempts to deal with this problem after the manner of a structural psychology. For this matter of the changing vividness of the various parts of the given organic experience is not in itself the whole of the changes that occur. There is something in the organization as such that escapes us when we analyze the experience. And this something has a very real part in giving its character to the revived process as distinct from the original experience. This, the structuralist says is mere form and so counts for nought in the final estimate of the make-up of the processes. This is an untenable position. We must heed these hints as to significance, which the functional view can give us. This help is especially valuable in this present case. The very essence of the difference between the sensory and the memory process consists in the different meaning attaching to them individually. But, using the functional view as it should be used, as a guide for the analysis of the structural method, the present study serves as an example of the possibility of explaining these significances, in part at least, by the aid of such analyses. The difference between a given sensational experience and the memory of the same experience, which is clearly one of meaning, is largely accounted for in our analysis as content differences. It lies chiefly in the different *start*, or *awakening*, of the peripheral sensory processes and in the different relative parts played by the various factors.[1]

[1] The MS. of this article was received July 14, 1904.—ED.

FROM THE UNIVERSITY OF CALIFORNIA PSYCHOLOGICAL LABORATORY.

COMMUNICATED BY G. M. STRATTON.

VII. The Effect of Verbal Suggestion upon the Estimation of Linear Magnitudes.

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The purpose of this investigation was to find how far, and in what direction, the visual estimation of a linear magnitude could be affected by suggestion of certain possible errors in such estimation, the subject knowing that the suggestions were purely arbitrary, *i. e.*, that they had no reference to any foreseen tendency to err in either direction.

The general method of the investigation was to show the subject for a brief time two small objects at a predetermined distance apart, and to let him subsequently place two similar objects so as to include between them an interval which he judged to be equal to that between the first two. The suggestions were introduced by showing to the subject along with the standard interval certain printed mottoes containing the random suggestions of possible errors in the reproduction of the interval; *e. g.*, 'Don't make too long,' 'Make Short,' etc. Then from the results of his reproductions the attempt was made to determine whether or not the suggestion had produced any effect.

Three different forms of apparatus were employed, but as the differences were chiefly mechanical, and the principle of operation identical in all, the description of the second form will suffice.

Two low, dead-black screens were built up on a table. The screen nearer the subject was high enough so that when seated his horizontal line of sight passed just over it. In the farther screen there were just above this line two long horizontal slots,

†Deceased.

the lower one being 2.2 cm. in width, and the upper one 1 cm. in width, having behind them backgrounds of the same blackness as the screens. Through the lower slot and against this background were exposed the printed slips bearing the mottoes, resting on a wooden ledge fastened to the back of the screen just below the edge of the slot. On a similar ledge behind the upper slot were exposed two white pegs .8 cm. in diameter and long enough to have their ends hidden by the screen. These pegs could be moved along the ledge, and hence adjusted for various intervals between them. On the near side of the nearer screen and just below the top, was a ledge on which the subject moved little pegs similar to those just described, and thus reproduced his estimation of the standard interval.

Over the front of the farther screen was made to slide a movable screen having a single horizontal slot through which either of the two slots in the stationary screen could be exposed, but not both together. Thus the subject saw either the motto in the lower slot, or else the standard distance marked off by the two white pegs appearing as rectangles 1 × .8 cm. in the upper slot, or else both slots were altogether hidden. The distance from the subject's eye to the nearer screen was 40 cm., and from the nearer screen to the farther was 80 cm.

The mode of operating the apparatus was sufficiently simple. The proper motto being in the lower slot, and the pegs having been properly spaced in the upper, and both slots being hidden by the movable screen, the operator, after due warning to the subject, raised the screen one notch and exposed the motto for two seconds; then raised it a second notch and exposed the standard interval for two seconds; then dropped it one notch and left the motto again exposed. The subject immediately so placed his pegs on the ledge as to mark off his estimate of the space interval, and the operator recorded the length so marked, reading it from a scale hidden from the subject's vision by a narrow strip of black paper projecting above the ledge.

1. First Set of Experiments.

In this first work only two subjects were engaged and a variety of suggestion mottoes were used, viz., '*Make short enough*,

'*Make long enough*,' '*Don't make too long*,' '*Don't make too short*,' '*Make short*,' '*Make long*,' a nonsense motto '*Zwp fjvic bgzx asye*,' and a meaningless sentence '*Life is real where*.' These mottoes were printed in black capitals 1.2 cm. high on white cardboard.

In groups *A*, *B* and *C* four standard lengths for estimation were used, 16, 22, 28 and 34 cm. In group *D* standards of 24, 26, 30 and 32 cm. for subject C. and 12, 14, 18 and 20 cm. for subject Y. Long standards were used for subject C. in this group because from examination of results in the preceding groups it seemed that the long standards would give more definite results; and since standards for this subject were changed, it was thought advisable to change standards for the other subject also. Thus any possible difficulty from too long use of the same standards was obviated. The four standards employed in any group were given in succession with each motto, in an order determined by lot, the order of succession of the mottoes being changed for each day. A 'nonsense motto' was used in order that the tests without suggestion might be under conditions as like as possible to the others, except for the suggestion itself.

Tables I. and II. give in detail the results of this investigation. Instead of finding the average lengths reproduced with different mottoes it was deemed simpler to interpret the data by aggregation. The number tabulated under a given motto for a given day is therefore the sum of all the judgments taken that day for that motto. As remarked above, the series in both tables are arranged in four groups, which differ amongst themselves in regard to the mottoes and standards used, and also in that a month's interval elapsed between the work of group *C* and that of group *D*. For convenience in examining the tables, totals are given under each group for such columns as it is desirable to compare. As all the mottoes are not used on all the days, only such days are included in forming the totals as make the totals in the same horizontal line properly comparable.

An examination of these tables leads to some interesting conclusions. First, we find by comparison of daily totals and general totals, that the suggestion produces a definite, though slight, effect. The results for 'Make short enough' are in both

TABLE I.

BASED ON 650 JUDGMENTS; SUBJECT, MISS C.

	1	2	3	4	5	6	7	8	9	10	11
	Day of Group.	No. of Judgments Each Motto.	Standard (Sum).	Nonsense Motto.	"Life is Real Where."	"Make Short Enough."	"Don't Make Too Long."	"Make Long Enough."	"Don't Make Too Short."	"Make Short."	"Make Long."
Group *A* (Eight different standards, 11–30 cm. long, were used in this group).....	1	9	189	199		—	212.7	—	—		
	2	8	167	179		—	—	180.7	—		
	3	10	202	221.5		227	225	223.5	224		
	4	10	202	218		224.5	214	220	223		
	5	10	202	—		220	221.5	216	221		
	6	15	320	343.6		—	341.5	—	342.9		
Sum of days 3, 4, 5		30	606	—	—	671.5	660.5	659.5	668		
3, 4, 5, 6...		45	926	—	—	—	1,002	—	1,010.9		
3, 4, 6...		35	724	783.1	—	—	780.5	—	789.9		
Group *B* (Standards, 16, 22, 28, 34 cm.)...	1	11	248							259.2	258.3
	2	16	322							302.5	305.2
	3	24	588							584	597.6
	4	24	660							650.7	680.3
Sum.....		75	1,818							1,796.4	1,841.4
Group *C* (Standards, 16, 22, 28, 34 cm.)...	1	8	200	216.6	205		210.2		211.7		
	2	9	210	196.2	202.1		196.3		205.4		
	3	9	204	200.5	198.2		194.3		202.1		
Sum.....		26	614	613.3	605.3		600.8		619.2		
Group *D* (Standards, 24, 26, 30, 32 cm.)...	1	6	170	—	—		183.2		175.3	172	185.5
	2	10	276	279.1	279.1		284.6		280.5	279	279.6
	3	7	206	209	211.6		221.7		213.6	203.3	212.5
	4	6	162	165.6	157.3		165.2		156.2	164.5	170
S. of days 1, 2, 3, 4		29	814	—	—		854.7		825.6	818.8	847.6
2, 3, 4...		23	644	653.7	648		671.5		650.3	646.8	662.1
Total, *C* & *D* (except day 1).....		49	1,258	1,267	1,253.3	—	1,272.3	—	1,269.5		
Total, *A* (except days 1, 2) *C* & *D*		100	2,354	—	—	—	2,457.5	—	2,455.7		
Total, *B* & *D*.....		104	2,632	—	—	—	—	—	—	2,615.2	2,689

cases greater than those for 'Make long enough'; the results for 'Make long' are greater than those for 'Make short' for subject C., and also greater for subject Y. in group *D*, although less in group *B* for this subject. Similarly, results for 'Don't make too long' are pretty uniformly greater than those for 'Don't make too short' for subject Y., and also for subject C. in group *D*, but not for this observer in groups *A* and *C*.

TABLE II.

BASED ON 598 JUDGMENTS; SUBJECT, MR. Y.

	1	2	3	4	5	6	7	8	9	10	11
	Day of Group.	No. of Judgments Each Motto.	Standard (Sum).	Nonsense Motto.	"Life is Real While."	"Make Short Enough."	"Don't Make Too Long."	"Make Long Enough."	"Don't Make Too Short."	"Make Short."	"Make Long."
Group *A* (Eight standards 11–30 cm. long).	1	9	189	176		—	176.5	179.7	—		
	2	10	202	188		197	188	192.5	190.5		
	3	10	202	186.5		191	190	194.5	186.5		
	4	15	320	297.6		289	293.8	—	289.2		
Sum of days, 2, 3, 4		35	724	672.1		—	671.8	—	666.2		
2, 3...		20	404	374.5		388	378	387	377		
Group *B* (Standards 16, 22, 28, 34).....	1	21	534							503.3	487.8
	2	22	538							499.9	491
	3	19	514							499.8	500.9
	4	20	524							487.2	488.5
Sum.....		82	2,110							1,990.2	1,968.2
Group *C* (Standards 16, 22, 28, 34).....	1	11	320	283.9	276.8		285.1		287.8		
	2	11	278	252.5	248.8		258.5		255.6		
	3	9	198	176.5	178.1		175.1		172.2		
Sum.....		31	796	712.9	703.7		718.7		715.6		
Group *D* (Standards 12, 14, 18, 20).....	1	6	98	94.7	91.7		92		94.3	92.2	92.8
	2	6	90	86.6	86.3		89.8		88.1	85.6	92.4
	3	6	102	94.9	94.3		94.3		91	91.4	95
Sum.....		18	290	276.2	272.3		276.1		273.4	269.2	280.2
Total, *C* and *D*.....		49	1,086	989.1	976		994.8		989	—	—
Total, *A* (except day 1) *C*, *D*.....		84	1,810	—	—		1,666.6		1,655.2	—	—
Total, *B* and *D*.....		100	2,400	—	—	—	—	—		2,259.4	2,248.4

Since group *B* followed group *A* and group *C* followed group *B* without gap, but a month elapsed between groups *C* and *D*, and since the difference in the presumable effects of the same mottoes occurs only between group *D* and the other groups, we must conclude that the uniformity is too great to admit of an explanation except by potency of the suggestion from the mottoes.

Second, this suggestion-effect varies both according to the individual to whom the suggestion is made, and also according to circumstances. The disagreements just referred to as existing between group *D* and the preceding groups is evidence upon the

latter of these points. The data within these groups are reasonably self-consistent, showing that on almost every separate day the same effect was produced, but that during the month's interval the subject had gotten over into a condition such that the difference between the effects produced upon him by two opposing formal suggestions was of opposite sign to what it was earlier.

Third, the mere words 'long' and 'short,' regardless of their content, seem to affect the estimation under certain circumstances. This is illustrated by Table III., which gives the sums for the mottoes containing the word 'short' and the sums for those containing the word 'long' from group *D* of both tables.

TABLE III.

Subject.	No. of Judgments.	Standard.	Mottoes Containing the Word	
			"Long."	"Short."
C.	58	1628	1702.3	1644.4
Y.	36	580	556.3	542.6

From this table it will be seen that the total for mottoes containing the word 'short' is less in both cases than that for mottoes containing the word 'long.' Similar totals from group *A* give exactly opposite results for Table I., and neutral results for Table II. (*i. e.*, in the latter case the totals are about equal).

Now these results, taken as they are merely from the group totals, may either be the result of chance, or they may be due to the existence of a different attitude towards positive and negative suggestions, causing the subject at any given time to incline to act in accordance with one and in opposition to the other; or they may be due to a tendency to be influenced by the mere words 'short' and 'long,' as said above. The likelihood of this latter explanation led to the group of experiments which follow under section 2.

Fourth, a motto which has interest for a subject seems to give greater lengths in the reproduction than an uninteresting one. The nonsense mottoes in group *A* (except for a single day for subject Y.) give smaller totals than do the other mottoes, which in this part of the experiment were not yet so familiar as

to lack interest; while in groups *C* and *D* the motto 'Life is real where,' which the subjects declared was much more empty and uninteresting than the 'nonsense' motto, and hence should be taken as the criterion in these groups, gives smaller totals than the averages for the suggestion mottoes, as show in Table IV.

TABLE IV.

Subject.	Mottoes with content. (Average of columns 7 and 9 of groups *C D*, omitting row 1 of *D*, Table I.)	Mottoes without content. (Total of column 5 of same days.)
C. (Table I.)	1270.8	1253.3
Y. (Table II.)	991.9	976.0

The indication of this comparison is of course very unsatisfactory, but seems at least to warrant a special investigation on this point.

2. SECOND SET OF EXPERIMENTS.

The apparent effect of the mere words 'long' and 'short' in the first set of experiments led to the second set, in which the mottoes used were only three in number, viz.: 'long,' 'short,' and 'XXXX.' The apparatus differed from that described above only in the substitution, for the pegs, of white paper squares on a black screen, one square of the pair being on a strip of black paper running in grooves behind a slot in the screen, so that the adjustments, *i. e.*, the various distances of separation of the squares, were obtained by simply sliding the strip along. Three standard distances were used, viz.: 17, 18 and 19 cm., being given in such order that each was preceded by each of the others about an equal number of times, and each of the three used an equal number of times on the same day. Each of the mottoes was given an equal number of times with each of the standards, in order determined by lot. The letters of the mottoes were so spaced as to cover the same extent in every case and so exclude the possibility of a difference due to mere space contrast or assimilation.

Four subjects were employed, and the results were not very uniform, two of the subjects showing no decided tendency towards anything resembling a constant effect, while the other

two subjects, showed a clear general constancy of considerable difference throughout. The results for these two are given in Tables V. and VI.

TABLE V.

SUBJECT K.

Date.	Standard.	Times Used.	Sum for Standard.	Sum for "Long."	Sum for "Short."	Sum for "XXXX."
Sept. 18.	17	3	51	47.8	48.4	48.3
	18	3	54	53.6	52.4	53.9
	19	3	57	54.8	56.2	58.0
			162	156.2	157.0	160.2
Sept. 24.	17	5	85	79.9	79.2	81.5
	18	5	90	84.4	84.3	85.1
	19	5	95	93.5	95.5	94.3
			270	257.8	259.0	260.9
Sept. 25.	17	6	102	94.6	98.6	98.3
	18	6	108	104.9	104.4	103.0
	19	6	114	107.5	113.6	111.7
			324	307.0	316.6	313.0
Sept. 26.	17	6	102	92.7	96.8	95.1
	18	6	108	106.6	107.2	105.0
	19	6	114	110.4	112.1	112.9
			324	309.7	316.1	313.0
Oct. 2.	17	6	102	94.1	95.5	92.7
	18	6	108	101.8	104.5	103.8
	19	6	114	111.4	114.8	113.7
			324	307.3	314.8	310.2
Oct. 4.	17	4	68	58.1	62.3	60.6
	18	4	72	67.2	65.7	68.6
	19	4	76	72.7	73.4	73.2
			216	198.0	201.4	202.4
Grand Total.		90	1620	1536.0	1564.9	1559.7

By examining Tables V. and VI. it will be seen that for Subject K. the figures for the motto 'short' are with two exceptions greater than the figures for the motto 'long,' and for subject M. the reverse is true, again with two exceptions. In the daily totals, however, there are no exceptions. In spite of the fact that the other two subjects gave neutral results, the hypothesis that the words 'long' and 'short' of themselves are capable of influencing the estimation of distances seems well

TABLE VI.

SUBJECT M.

Date.	Standard.	Times Used.	Sum for Standard.	Sum for "Long."	Sum for "Short."	Sum for "XXXX."
Sept. 5.	18	6	108	108.3	103.2	108.8
	19	6	114	123.2	117.0	116.8
			222	231.5	220.2	225.6
Sept. 6.	17	7	119	118.2	113.0	118.5
	18	5	90	92.8	91.3	86.1
			209	211.0	204.3	204.6
Sept. 11.	18	8	144	144.6	140.5	141.7
	19	6	114	116.0	117.8	112.1
			258	260.6	258.3	253.8
Sept. 13.	17	8	136	139.8	134.6	137.8
	18	8	144	148.3	145.5	146.6
			280	288.1	280.1	284.4
Oct. 7.	17	7	119	117.3	116.0	119.0
	19	7	133	130.2	134.3	134.7
			252	247.5	250.3	253.7
Oct. 11.	17	7	119	121.0	115.0	117.4
	19	7	133	136.7	132.5	138.0
			252	257.7	247.5	2554
Oct. 14.	17	1	17	17.1	16.0	17.0
	18	3	54	50.3	48.9	52.9
	19	4	76	76.2	72.7	75.1
			147	143.6	137.6	145.0
Grand Total.		90	1620	1640.0	1598.3	1622.5

grounded, for in view of the discussion of the first group of experiments we might expect that the suggestion effect would be contrary in certain different subjects, and lacking in others. Thus the influence of purely formal and arbitrary suggestion seems even more clearly evidenced by this second group of experiments than by the first.

VIII. Experiments on the Unreflective Ideas of Men and Women.

BY GENEVIEVE SAVAGE MANCHESTER.

In 1891, Professor Jastrow made a study[1] of the mental differences of men and women, using as material, lists of one hundred words each, written by men and women students in his classes. These lists were written as rapidly as possible in order that they should be natural and unreflective. From a comparison of twenty-five men's lists, with an equal number of the women's lists, he concluded that the feminine traits of mind revealed by the study are: 'An attention to immediate surroundings, to the finished product, to the ornamental, the individual, and the concrete, while the masculine preference is for the more remote, the constructive, the useful, the general, and the abstract.' A few years later, a similar experiment was made at Wellesley College. Miss Nevers,[2] who made the study, found that her results were strikingly different from those obtained by Dr. Jastrow. Later, however, it was discovered that for the most part, this difference in results was due to a deviation in method, the instruction to write the lists as rapidly as possible, having been omitted by Miss Nevers. A repetition of the experiment conforming closely to Professor Jastrow's procedure produced results which supported some of his conclusions, but not all.[3]

[1] *New Review*, Vol., V, 1891, pp. 559 to 569.

[2] Psychological Review, 1895, pp. 361 to 367.

[3] Other experiments on the mental differences of men and women have been carried on, though not along the lines suggested by Professor Jastrow. Helen Bradford Thompson, in a study of the mental differences of men and women came to the following conclusions (*Psychological Norms in Men and Women*, Univ. Chic. Press, 1903, page 171): "Women are decidedly superior to men in memory, and possibly more rapid in associative thinking. Men are probably superior in ingenuity. In general information and intellectual interests there is no difference characteristic of sex." For other references and results v. Havelock Ellis' *Man and Woman* (Contemp. Science Series).

Preliminary to a further study of the mental differences of the sexes, I have repeated Dr. Jastrow's experiment at the University of California. To get the required lists, all the men and women in several classes in general psychology were given blank sheets of paper on which were spaces for 100 words, the writer's name, sex and the time required to write the list. The only instructions given were to write at top speed and to avoid writing words in sentences. From the large number of papers received, three sets were selected, each set containing twenty-five men's lists and twenty-five women's. In selecting the lists, the only requirements were that the lists should seem natural and unreflective and that the same word should not appear more than once in the same list; that is, that each list should furnish 100 different words. It is possible that this last requirement may have been a deviation from Professor Jastrow's method. Upon inquiring, he wrote me that he was not certain whether the Wisconsin lists had been kept free from repetitions or not. With a very few exceptions, the same word does not appear twice in any one paper in the California lists. Having selected the lists, the words of each set were then separately tabulated under the following twenty-five heads, the words written by the men and women being kept apart in each set: (1) animal kingdom, (2) verbs, (3) proper names, (4) adjectives, (5) implements and utensils, (6) abstract terms, (7) wearing apparel and fabrics, (8) vegetable kingdom, (9) building and building materials, (10) parts of the body, (11) geographical and landscape features, (12) other parts of speech, (13) miscellaneous, (14) interior furnishings, (15) meteorological and astronomical, (16) mineral kingdom, (17) occupations and callings, (18) conveyances, (19) stationery, (20) foods, (21) educational, (22) arts, (23) amusements, (24) mercantile terms, (25) kinship.

After classifying each of the three sets separately, they were then combined and the set thus obtained consisting of seventy-five men's lists and seventy-five women's lists, was classified as the smaller sets had been.

The division of the words under the above twenty-five heads follows the classification of Dr. Jastrow in order that the Cali-

fornia results might be comparable with those of Wisconsin, although certain objections to the division might be urged. For example it might be pointed out that the procedure of Dr. Jastrow does not admit of exact repetition, though this is essential to a correct testing of results. No two experiments would tabulate the words in the case of the twenty-five classes under exactly the same heads. This difficulty arises from the fact that some of the classes are vague. An illustration of this lack of clear definition may be drawn from the class 'interior furnishings.' Many of the household articles that women use, are of course, 'implements and utensils' and just what household articles should be classed as 'interior furnishings' and what as 'implements and utensils' is not clear. In case most of the implements women use about their work are classed as 'interior furnishings,' the preponderance of the men in the implement group loses all its significance. The class 'foods' is not clearly to be distinguished from the 'animal,' 'vegetable' and 'mineral kingdom' groups, since all foods can be classed under these three heads. Here again there is a chance for words to stray. The class 'educational' is also exceedingly vague. Each person who uses this system of classification will probably classify under this group somewhat differently. The personal factor will come in to an appreciable extent in each repetition of the experiment and absolute uniformity of method will not be secured.

These defects are easier to see than to remedy. If a classification free from them is possible, it must probably be made along more strictly logical lines. The words would need to be classified several times instead of once, selecting in each classification some one principle of division.

In two cases, I have made slight changes in Dr. Jastrow's terminology. For his term 'unique words,' *unrepeated words* has been substituted, and for the term 'different words,' *vocabulary* has been used.

In Table A the results of the California experiments are given, together with those previously reported, arranged in the order in which the experiments were performed.

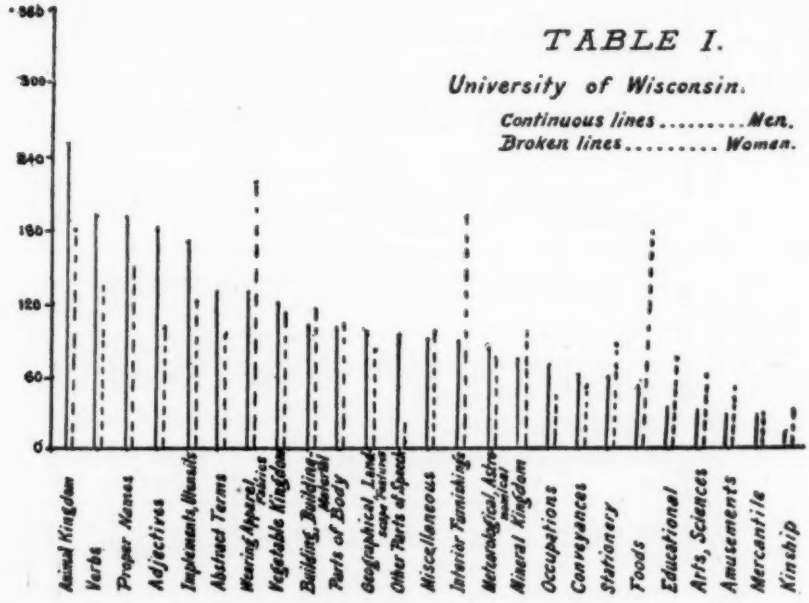
To aid in comparing the results, they have been represented

TABLE A.

	Wisconsin.		California Set I.		California Set II.		California Set III.		Wellesley.	Combined California Set.	
	Men.	Women.	Men.	Women.	Men.	Women.	Men.	Women.	Women.	Men.	Women.
1. Animal kingdom	254	178	193	196	239	196	210	170	146	642	562
2. Abstract terms	131	97	137	117	152	114	51	71	101	340	302
3. Adjectives	177	102	207	267	201	247	216	283	300	624	797
4. Amusements	30	53	25	39	27	51	23	45	17	75	135
5. Arts	33	61	47	79	54	84	75	75	17	176	238
6. Buildings, building materials	105	117	127	131	116	145	120	144	86	363	420
7. Conveyances	62	52	40	43	42	48	51	58	19	133	149
8. Educational	34	76	68	69	59	97	50	55	102	177	221
9. Foods	53	179	104	109	85	81	53	45	88	242	235
10. Geographical, landscape features	97	80	113	104	110	116	83	123	70	306	343
11. Implements, utensils	169	121	86	45	114	99	144	103	139	344	247
12. Interior furnishings	89	190	64	82	78	128	129	147	212	271	357
13. Kinship	17	32	10	9	4	11	14	16	42	28	36
14. Mercantile terms	30	29	10	11	7	15	22	17	18	39	43
15. Meteorological, astronomical	85	76	64	53	102	99	91	110	109	257	262
16. Mineral kingdom	74	96	88	33	109	69	90	71	30	287	173
17. Miscellaneous	91	97	257	255	147	134	188	151	123	592	540
18. Occupations	71	47	47	30	58	31	76	44	24	181	105
19. Other parts of speech	96	5	112	146	90	73	123	90	164	325	309
20. Parts of the body	101	105	92	60	122	73	58	54	66	272	187
21. Proper names	194	153	98	106	99	128	56	41	81	253	275
22. Stationery	60	86	38	35	57	47	78	81	69	173	163
23. Vegetable kingdom	121	110	97	102	99	78	53	90	101	249	270
24. Verbs	197	134	286	257	259	218	360	299	279	905	774
25. Wearing apparel, fabrics	129	224	89	119	70	118	86	117	97	245	354
Totals	2500	2500	2499	2497	2500	2500	2500	2500	2500	7499	7497

graphically by a system of vertical lines, the lengths of which are proportionate to the numbers given in Table I. The continuous lines represent the number of words in each class used by the men, the broken lines, the number of words written by the women.

The order of arrangement of the classes in the diagram is, of course, arbitrary. For convenience, the classes are arranged in the order of their size, as obtained in the results of Professor Jastrow's men. The series begins with the class 'animal king-

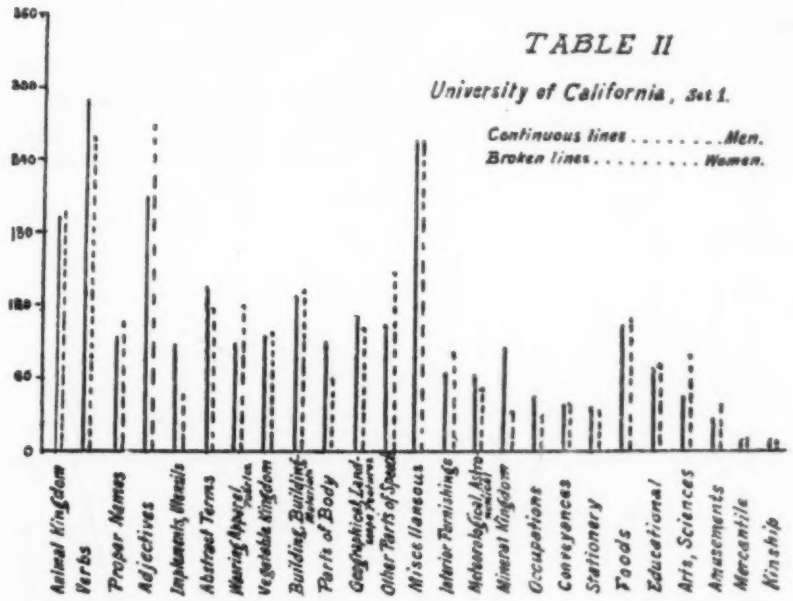


dom,' to which the men of the University of Wisconsin contributed the largest number of words, and ends with 'kinship,' the class to which they gave the smallest number of words. This order is kept for the women of the Wisconsin lists and for all the subsequent lists.

Turning now to Table I. to review the comparison of the Wisconsin men and women, it is seen at a glance that the women greatly preponderate over the men in the class of 'wearing apparel and fabrics,' 'interior furnishings' and 'foods'; to a less degree in the classes 'educational,' 'arts' and 'amusements.' In

mentioning terms denoting objects in the 'animal kingdom,' 'adjectives,' 'abstract terms' and 'implements and utensils,' the men exceed the women. Numerous other variations are shown, but these are the most striking.

A comparison of these results with those obtained by the California experiments discloses the fact that, while there is general agreement in several interesting particulars, there is nothing that can be called complete corroboration of the conclusions Professor Jastrow drew.[1] A prominent characteristic to be



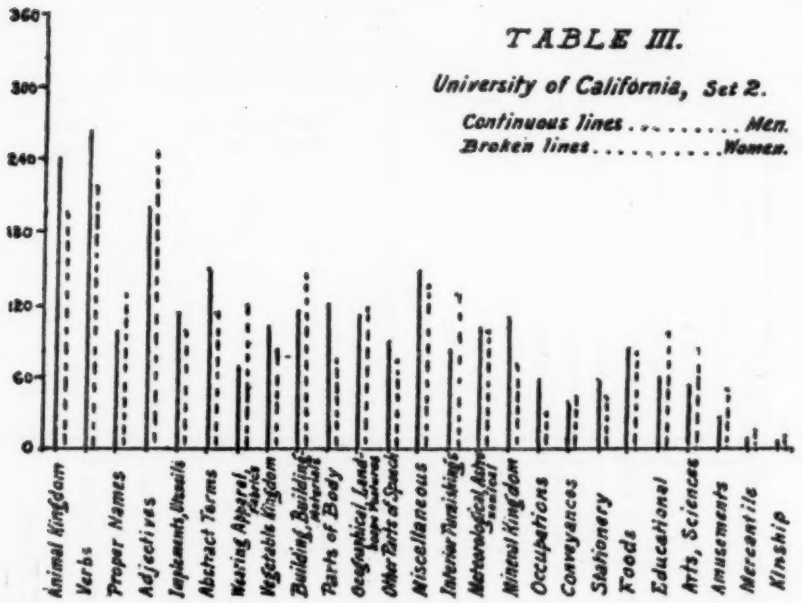
noted in the California experiments is the absence of the marked disparity between the men and women which the Wisconsin record shows. In the class 'wearing apparel and fabrics,' the California women clearly exceed the California men but in a less degree than the Wisconsin women exceed the Wisconsin men. (Compare Tables II., III., IV. and V. with Table I.)

The same relation holds for the class 'interior furnishings'; but in the case of 'foods,' one of the three classes in which the

[1] The fact that there are no men's lists in the Wellesley material is an obvious drawback in comparing them with Wisconsin and California lists and for that reason they will, for the time, be left out of account.

Wisconsin women markedly exceeded the Wisconsin men, the result differs from that obtained by Professor Jastrow. In one of the California sets, the women exceed the men slightly (see Table II.), while in the other two sets, the men are slightly in advance of the women.

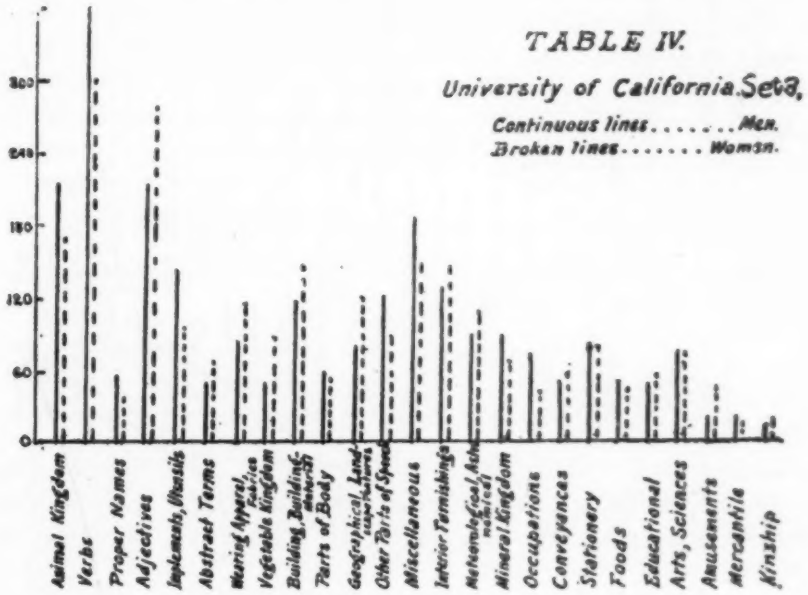
The California lists agree with the Wisconsin lists in that the women exceed the men in the classes 'educational,' 'arts,' and 'amusements'; but as before, the California men and women differ less from each other than the Wisconsin men and women



The notable ratios in which the Wisconsin men exceeded their women classmates in terms belonging to the classes 'animal kingdom,' 'proper names' and 'adjectives' do not hold for the California lists. The California sets all agree with the Wisconsin lists in that the men lead the women in every case in mention of 'verbs' and 'implements and utensils.' A general agreement of both Wisconsin and California results is to be found in the fact that both men and women drew the larger part of their words from the classes arranged on the left half of the tables, while the classes to the right, such as 'educational,'

'amusements,' 'mercantile terms' and especially 'kinship' furnish comparatively few of the surface ideas.

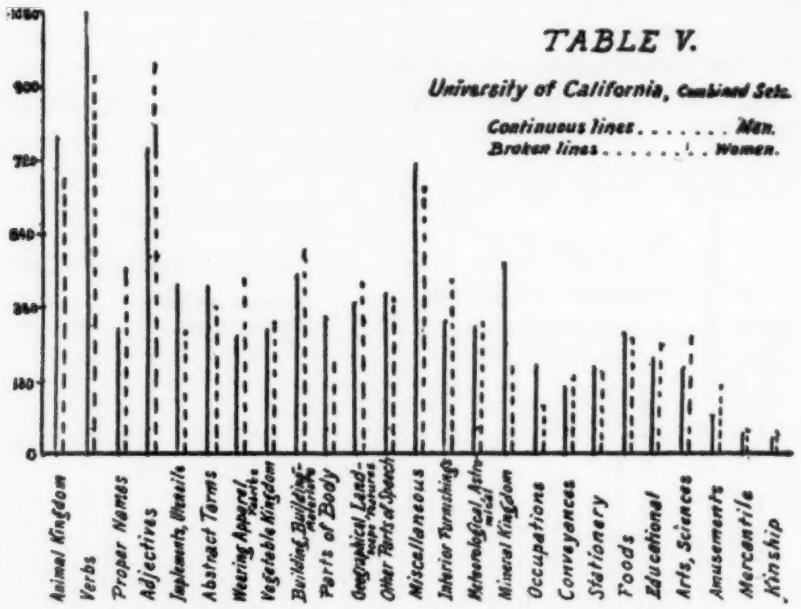
In the Wisconsin lists, Dr. Jastrow found that the vocabulary of the men was greater than that of the women. The same result was obtained in all three of the California sets. In Table VI. the results of this part of the experiment are tabulated, the results of the Wisconsin and Wellesley experiments being included.[1]



A study of this table shows that in each of the five sets, the men have used a larger percentage of different words than the women of the same set. In set II. of the California series, however, the women exceed the men of set I. in vocabulary. It is to be remarked that the women in all three of the California sets and also in the Wellesley set, exceed the Wisconsin men in vocabulary. It is also to be noted that the difference between the vocabularies of the Wisconsin men and women is considerably greater than that between the California men and women.

[1] The column headed 'percentages' indicates the ratio of the vocabulary to the total number of words written.

The vocabulary of the Wisconsin men is 10 per cent. larger than that of their women classmates, while, in no case, does the vocabulary of the California men exceed that of the California



women more than 4 per cent. In every set, both the men and women in the California experiment use larger vocabularies than either the men or women of Wisconsin. It would, of

TABLE VI.

	Unrepeated Words.		Vocabulary.		Percentages.	
	Men.	Women.	Men.	Women.	Men.	Women.
Wisconsin.	746	520	1376	1123	55	44.9
California Set I.	1000	949	1471	1397	58	55.9
California Set II.	1170	1079	1583	1509	63.32	60.36
California Set. III.....	1079	978	1489	1407	59.56	56.28
Combined Calif. Set.	1975	1950	3119	3048	41.58	40.64
Wellesley.....		868		1306		52.25

course, be unwarranted to conclude from these results (though the thought is at least suggested) that the men and women of California have more diversified interests that those of Wiscon-

sin, and that the men and women of California differ from each other less than the men and women of Wisconsin. Only one set of lists is given here for the University of Wisconsin, and additional sets might change the proportions materially. The matter of the treatment of plurals may account in great part for the larger vocabularies obtained in the California experiments. I have in all cases counted the singular and plural of the same idea as two different words. The justification for this is to be found along psychological rather than etymological lines. Etymologically, the words *horse* and *horses* are practically the same, but the mental picture, or idea, corresponding to each is different. If Professor Jastrow did not make this distinction, but counted the singular and plural forms of an idea as the same word, the vocabularies in the Wisconsin study would be correspondingly low.

That the men exceed the women in vocabulary in each of the five sets, is significant, even if the superiority on the part of the men is slight. It should be remembered that in the combined California set, the total number of words was three times as large as in the other sets. It is to be noted, further, that not only the percentage of difference, but the absolute difference between the vocabularies of the men and women is greater in the 2,500-words sets than in the 7,500-word set. In the smaller sets, the difference varies from two per cent, to a little more than three per cent. while in the large set, the difference is leveled to one per cent. It seems likely that if the number of lists were indefinitely increased, the difference in vocabulary between the men and women would diminish regularly as the limits of the language were approached.

Leaving now any further comparison of the California results with those obtained by other experiments, a more profitable field for study lies in the examination of the cumulative results of the experiments at Wisconsin and California, in order to discover in what features, if any, all of the results agree. If this study is to disclose any real differences between the unreflective ideas of the sexes, such differences should be evident in all of the sets of lists, or at least in a pronounced majority of them. The most significant differences, then, revealed by these

experiments, will be those which appear in every one of the four sets.

To indicate the agreement or disagreement of the different sets as regards the classes of words used Table VII. was prepared.

TABLE VII.

+ MEN LEAD. — WOMEN LEAD.

	Wis.	Calif. I.	Calif. II.	Calif. III.	Calif. Comb.
Animal kingdom	+	−	+	+	+
Verbs.	+	+	+	+	+
Proper names.	+	−	−	+	−
Adjectives.	+	−	−	−	−
Implements and utensils	+	+	+	+	+
Abstract terms	+	+	+	−	+
Wearing apparel, fabrics	−	−	−	−	−
Vegetable kingdom	+	−	+	−	−
Buildings, building materials	−	−	−	−	
Parts of body	−	+	+	+	+
Geographical, landscape	+	+	−	−	−
Other parts of speech	+	−	+	+	+
Miscellaneous	−	+	+	+	+
Interior furnishings	−	−	−	−	−
Meteorological, astronomical	+	+	+	−	−
Mineral kingdom	−	+	+	+	+
Occupations	+	+	+	+	+
Conveyances.	+	−	−	−	−
Stationery.	−	+	+	−	+
Foods.	−	−	+	+	+
Educational.	−	−	−	−	−
Arts, sciences	−	−	−	−	−
Amusements.	−	−	−	−	−
Mercantile terms.	+	−	−	+	−
Kinship.	−	+	−	−	−

In this table, the classes in which the men excelled the women in the number of words written are marked by a plus sign, while the classes in which the women led are indicated by a minus sign.

A review of the results of the classification into the twenty-five groups, shows a rather remarkable agreement in the five sets tabulated in Table VII. Of the twenty-five classes, eighteen show an agreement, either in all five cases or in four cases out of five. In the three classes in which the men lead most pronouncedly, namely, in 'verbs,' 'implements and utensils' and 'occupations,' the notion of action is prominent. In the classes in which the women lead, such as 'adjectives,' 'wearing apparel and fabrics,' 'interior furnishings' and 'buildings

and parts of buildings,' no such notion is evident. On the contrary, these show a preference for things at rest.

Running through all, or nearly all, of these agreements in results, there appears, beside the notion of action as contrasted with inaction, another element. In the cases in which the men lead, time is an essential factor; in the cases in which the women lead, space is the more prominent consideration. While the time and space conceptions are closely allied to the notions of action and inaction, they seem, nevertheless, to be not altogether identical. A further inference may be drawn from the cases in which there is agreement in all five sets. The fact that the men throughout draw a large percentage of their words from such classes as 'implements and utensils,' 'occupations,' and 'verbs' than the women do, and from the fact that the women lead throughout in the classes 'wearing apparel and fabrics,' 'buildings and building materials,' and 'interior furnishings,' it may be inferred that the unreflective ideas of both men and women concern the objects with which they are familiar and in which they have considerable interest. That the classes 'implements and utensils' and 'occupations' are of special masculine interest, will probably not be questioned, but such an interpretation of the verb class needs justification. This justification is found in the character of the verbs used. In a very large percentage of the cases in which men use verbs, these verbs are suggestive of action in the field of men's especial interest.

To make this clear, two lists of verbs are submitted, one secured from three men's papers and the other from three women's, the lists being taken at random in both cases. Such words as 'address' and 'telegraph,' classed here as verbs, may also be nouns. In such cases the context was taken as a guide in determining the sense in which the writer used the word. The lists follow:

A. (1) address, (2) telegraph, (3) fall, (4) rise, (5) call, (6) forget, (7) ride, (8) play, (9) ringing, (10) reading, (11) studying, (12) work, (13) play, (14) tick.

B. (1) shoot, (2) tick, (3) twitch, (4) cure, (5) hit, (6) miss, (7) aim, (8) blow, (9) shoot, (10) sail, (11) hoist, (12) lift, (13) pump, (14) rush, (15) study, (16) judge.

The first series of verbs was taken from women's lists, the second from men's. The masculine character of the second series is unmistakable and was so judged by several persons to whom the lists were read without disclosing the actual source of each group.

With this further knowledge of the verbs used, it seems safe to say that the evidence justifies the statement that the unreflective ideas of men are controlled by the familiar and interesting acts and objects of their lives. Similiarly, the classes 'wearing apparel and fabrics,' and 'interior furnishings,' are recognized categories of peculiar feminine interest. It might be suggested, however, that buildings and building materials are not distinctly familiar and interesting to women. The objection falls when the character of the words drawn from this class is known. The words used were names of particular buildings and parts of houses, such as court house, church, gate, door, floor, fence, steps, marble. There is scant mention by the women of such distinctive building materials as bricks, mortar, cement and stone.

Just why women should exceed men in the classes 'arts,' and 'educational' is not evident, but taking the cue from the former cases, it seems that it might be because these classes of objects are more familiar to women than to men and of relatively more importance to them. Though men are the chief creators of art, women are more familiar with the ordinary art products, such as pictures and musical compositions. Similarly in educational matters, the women were probably more impressed with the parts of the educational system, such as lectures, texts and examinations, owing, perhaps to the fact that many of them were preparing to become teachers.

That the women lead in the category of amusements, is probably due to the fact that women, as a class, have more leisure than men. With the time to enjoy amusements of various kinds, women indulge more in them. Hence these things are more familiar to women than to men and come more readily to mind when there is a call for a rapid gathering of ideas.

Leaving now the cases where there is an agreement throughout all five sets, the agreements which appear in four

sets out of five deserve a word. In the classes 'animal kingdom,' 'abstract terms,' 'parts of the body,' 'miscellaneous,' 'mineral kingdom' and 'other parts of speech,' the men exceed the women in four sets out of five. The mention of objects belonging to the 'animal kingdom' is plentiful in the lists of both men and women, the difference between the number of times such words are written by men and women being, on the whole, not very large, but the fact is notable that in all cases, but one, the sex naturally most familiar with the various members of the 'animal kingdom' is the one which leads in this class. In the class 'abstract terms,' a similar condition prevails. While the total numerical lead of the men over the women is not great, it is, nevertheless, to be found in four cases out of five. That men have more interest and training in mathematical, physical and philosophical abstractions, might account for this difference. The significance of the men's lead in mention of 'other parts of speech' is not clear. In the classification used, this term embraces conjunctions, prepositions, interjections, pronouns and adverbs. Since the class was not subdivided, it is impossible to tell in which of the four parts of speech the men markedly excel. As they lead in verbs, it might be expected that they would lead in adverbs. So too, it might be expected that men would lead in prepositions and conjunctions since these deal with abstract relations.

Men also lead the women four times out of five in mention of 'parts of the body.' Just what, if anything, this implies, I have not determined, though it may be that the greater importance of the parts of a man's body, as tools for his daily use, keeps the conceptions of them more constantly in his mind.

That men lead in the class 'miscellaneous' may mean any one of several things. If the other groups in the classification happened to be more adapted to catch the surface ideas of women than those of men, the 'miscellaneous' class would be correspondingly large for the men. Another explanation of the men's superiority here might lie in the fact that men are interested in a greater number of objects and activities.

The lead of the men in the 'mineral kingdom' is probably due to the fact that they carve and chisel, mine and build, while women ordinarily do not.

'Conveyances' might have been discussed under the head of 'amusements,' as most of the words in this class seemed to be of that general character.

That the women in all of the California sets lead in the mention of adjectives seems significant. It has been found in the classes discussed before that the surface ideas of men concern action, the tools used in the performing acts, and the differentiations of particular acts into occupations; that is, their ideas are related to construction. The women, on the other hand, excel the men in the mention of articles of dress, house fittings, parts of houses, particular buildings and art products. There seems to be a real principle of difference here in the general character of the words written by the men and those written by the women. Men speak of the process of creating, women of the thing created. This is the same conclusion reached by Dr. Jastrow.

In view, then, of this tendency of the feminine mind toward things, rather than the doing of things, it seems natural that women should be more familiar with the qualities of things than men are. This preponderance of adjectives in the women's lists seems to bear out this supposition.

In the mention of terms of kinship, it is of interest to note that both the men and the women draw very sparingly from this class. This fact seems rather in opposition to the hypothesis before advanced that the surface ideas are of things familiar and interesting, for of course one's kindred are usually the persons seen oftenest and considered of greatest importance. It is probable that unconscious or even conscious selection played a part here. It is very likely that the persons writing the lists considered this work a sort of official act since the papers were to be returned to an instructor, and they would naturally refrain to a certain extent, from speaking of parents and other relatives. The very attitude the mind took in performing the task would inhibit ideas drawn from the family life.

In the classes which have not yet been discussed, 'proper names,' 'meteorological and astronomical terms,' 'stationery,' 'foods' and 'mercantile terms,' there is not enough regularity to warrant the drawing of any conclusions. In the class 'proper names,' it would be expected that the women would lead con-

siderably, since they show a preference for the concrete, rather than the abstract, but in two sets out of five, the men are ahead. Again, the natural expectation would be that men would write many more astronomical and meteorological terms than women, but in this class the men lead in only three cases out of five. Oddly enough, the men on the whole, in the California sets, lead slightly in foods, and the women in mercantile terms, very different results from those obtained by Dr. Jastrow.

Coming now to the last feature to be examined, namely, the time required to write the lists, it is seen from Table VIII. that the average time for the women of California is 5 minutes and 39 seconds. The average time for the men of California is 5 minutes and 47 seconds.

TABLE VIII.

	Average for Men.	Average for Women.	Average for Men and Women.
Wisconsin.			5 min. 8 sec.
California I.	6 min. 2 sec.	6 min.	6 min. 1 sec.
California II.	6 min. 17 sec.	5 min. 55 sec.	6 min. 6 sec.
California III.	5 min. 2½ sec.	5 min. 2 sec.	5 min. 2 sec.
Wellesley		5 min.	
Combined Calif. ...	5 min. 47 sec.	5 min. 39 sec.	

As Professor Jastrow does not give the average time for each sex separately, and as there are no men in the Wellesley list, these sets are not available for this comparison.

In each of the California sets, the time the women required to write the lists is slightly less than that of the men. This may mean, either that the women associate more quickly, or that they write more rapidly. That each student kept his own time renders these results less trustworthy than they would otherwise have been.

Having now presented the evidence at hand, it only remains to review the differences in the unreflective ideas of the sexes as suggested by these experiments.

From the results of the classification into the twenty-five groups, the following general statements in regard to the surface ideas of men and women may be made:

1. The surface ideas of both men and women pertain to objects which are familiar and interesting.

2. The dynamic aspect of objects is more attractive to men, while the static or completed aspect appeals more to women.

3. Time as a factor enters more largely into the surface ideas of men; space is more often a prominent feature of the surface ideas of women.

4. Men make a greater use of abstract terms, while women show a preference for the concrete and for descriptive words.

From the tabulation of the words used into unrepeated words and vocabulary, it is found that the range of the surface ideas of men, as a group, is slightly greater than that of women.

From the examination into the average time required for writing the lists, it is found that women are able to write one hundred associated surface ideas in somewhat less time than men.

All of the specific tendencies above mentioned seem to give concurrence to a general principle of difference between the sexes. The surface ideas of men are extensive rather than intensive, while the opposite is true of women. This conclusion is supported, not only by the fact that men show a preference for abstract terms, for action and for the time idea, while women prefer the concrete, the completed object and space relations, but also by the facts that men have a greater range of surface ideas than women, and to a certain extent by the fact that women have their reflective ideas more at hand, as shown by their shorter list-time. Men are interested in far-reaching relations existing between things; women give more attention to the minute analysis of things themselves.[1]

[1] The MSS. of these Studies were received October 17, 1904. — ED.

Explanation of Chart I.

I. W., February 10, normal after-image, 20 seconds exposure. II. W., February 10, normal after-image, 20 seconds exposure. III. W., February 10, normal after-image, 20 seconds exposure. IV. W., February 10, normal after-image, 20 seconds exposure. V. W., February 24, normal after-image, 20 seconds exposure. VI. W., February 24, normal after-image, 20 seconds exposure. VII. W., February 24, normal after-image, 20 seconds exposure. VIII. W., February 24, normal after-image, 20 seconds exposure. IX. W., February 24, normal after-image, 20 seconds exposure. X. W., February 24, memory image controlled for green. (No exposure.) XI. W., February 24, memory image controlled for green. (No exposure.)

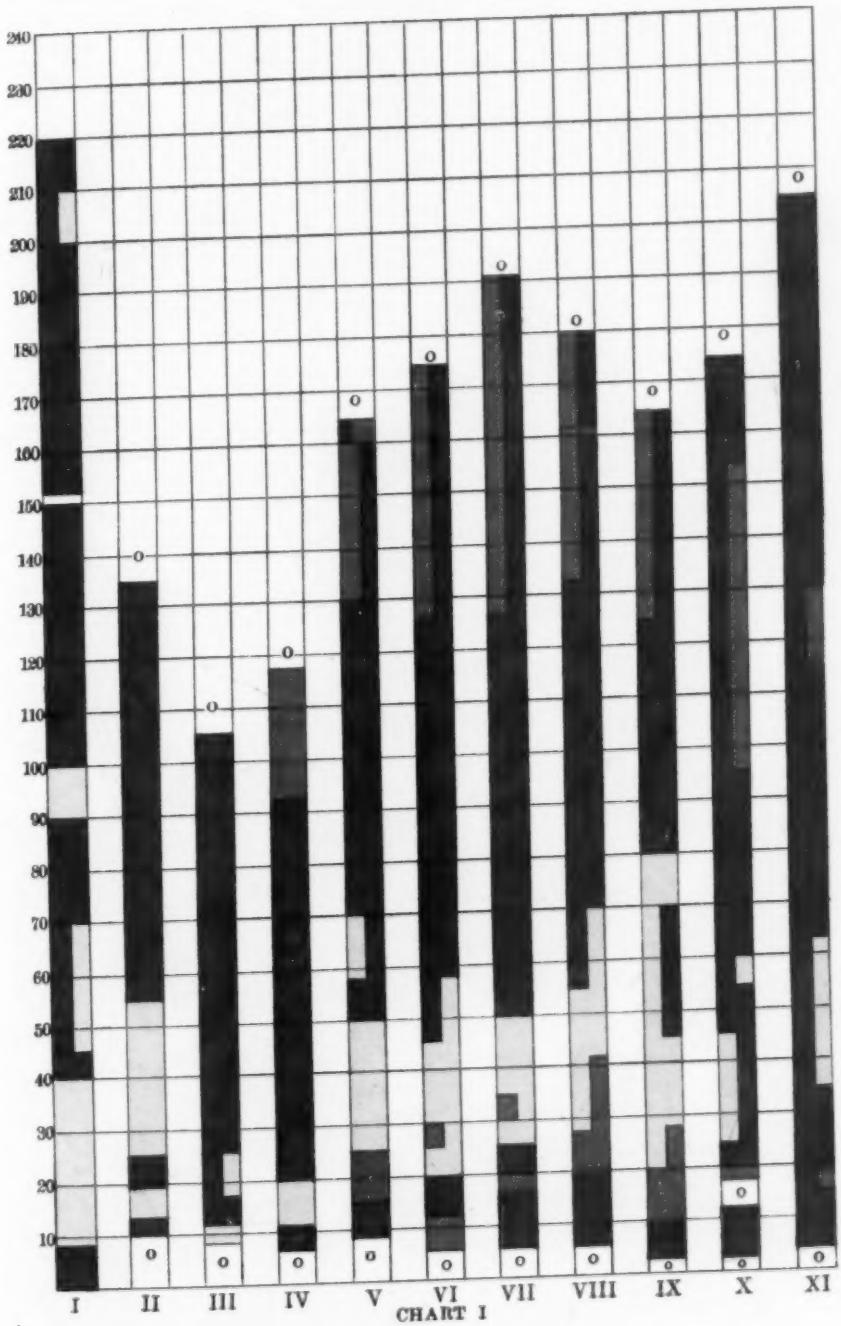

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CHART I

Explanation of Chart II.

I. H., April 23, normal after-image, 20 seconds exposure. II. H., April 23, normal after-image, 20 seconds exposure. III. H., April 23, memory image controlled for blue. (No exposure.) IV. H., April 23, after-image controlled for blue, 20 seconds exposure. V. H., April 23, after-image controlled for blue, 20 seconds exposure. VI. W. April 28, normal after-image, 20 seconds exposure. VII. W., April 28, normal after-image, 20 seconds exposure. VIII,, W., April 28, memory image controlled for red. (No exposure.) IX. W., April 28, memory image controlled for red. (No exposure.) X. W., April 28- after-image controlled for red, 20 seconds exposure. XI. W., April 28, after, image controlled for red, 20 seconds exposure.

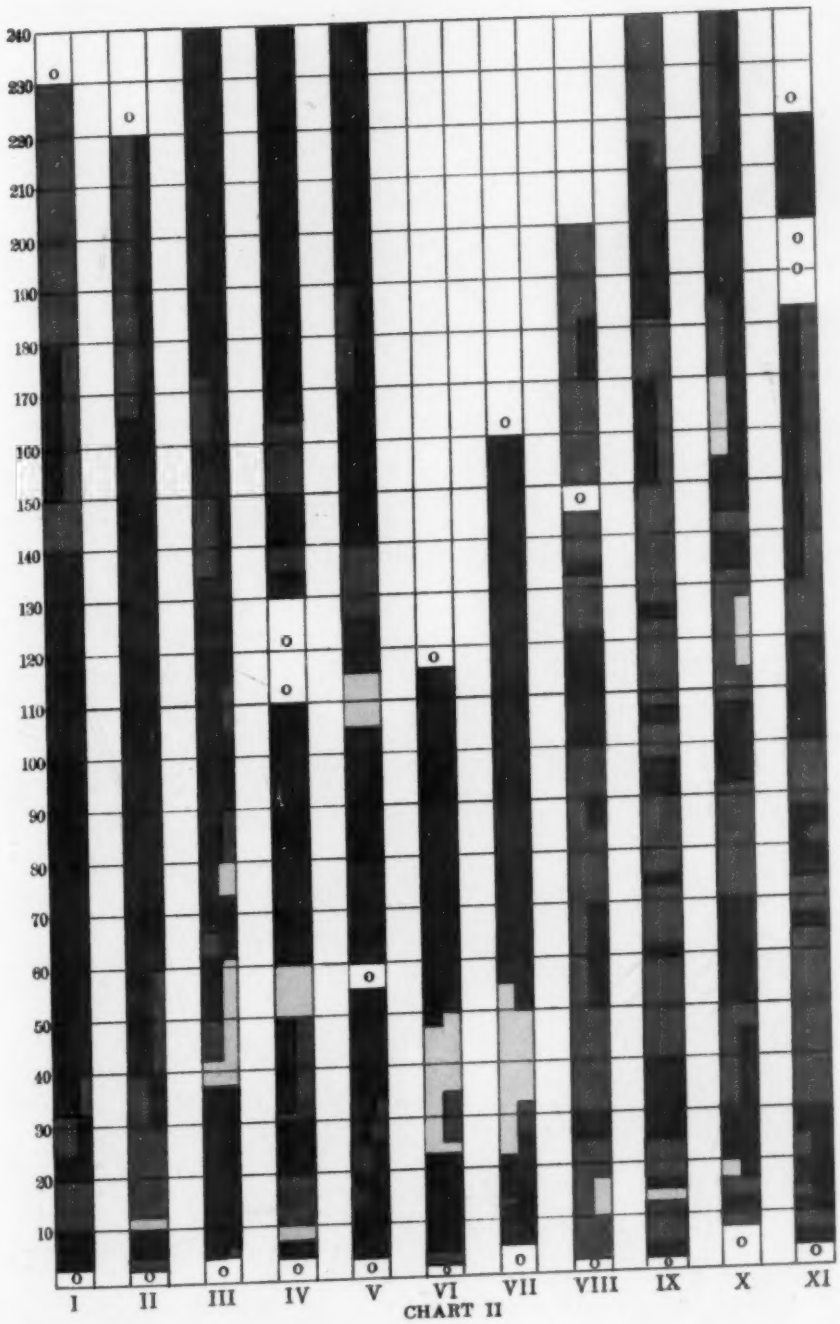
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CHART II